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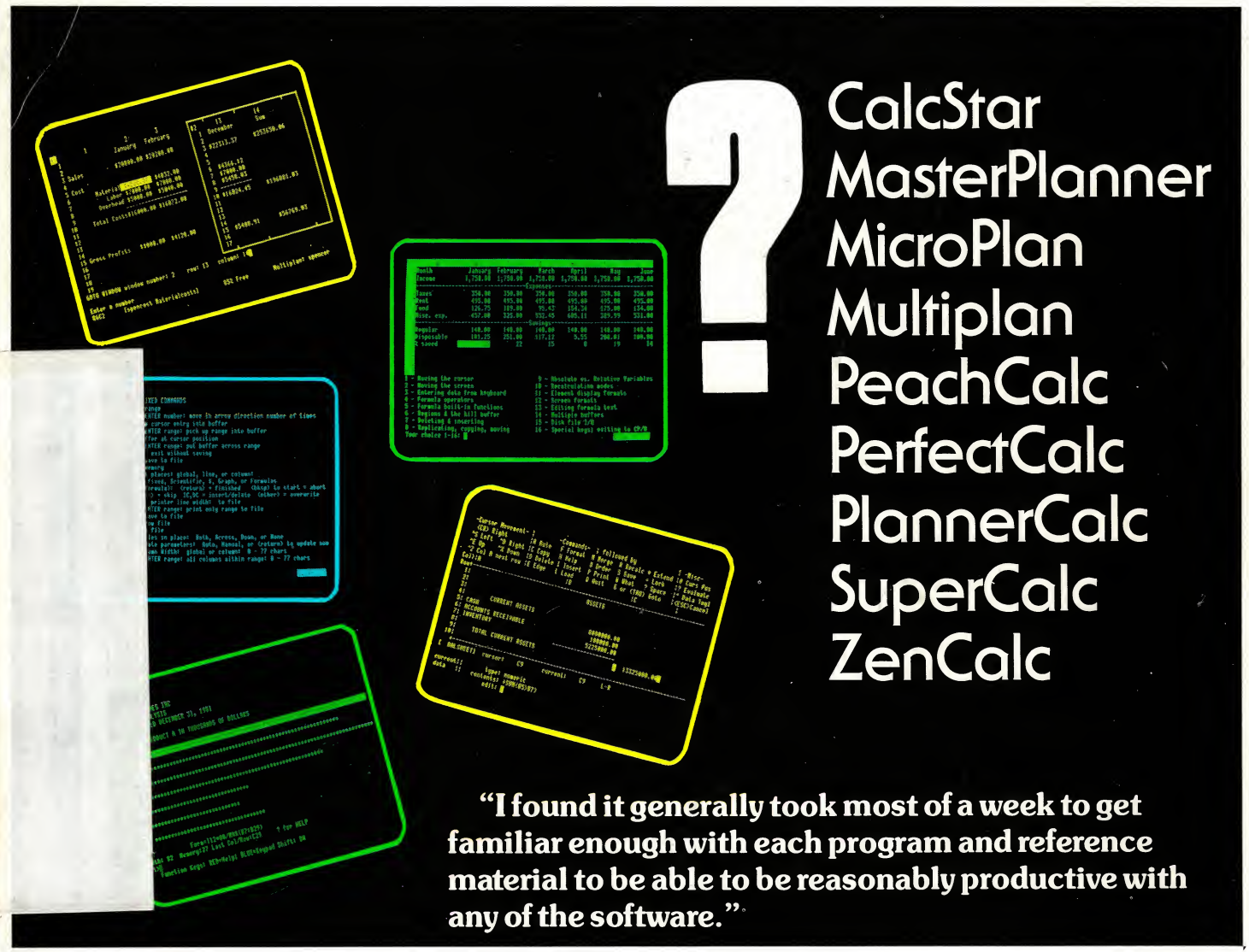
Winter 1983
Issue No. 4

The Independent Magazine for the Entire Zenith Computer Community

Which Spreadsheet is Best for You?



PLUS:

HUGCON 1

Interrupt Programming Under HDOS

Disk Controllers Compared

Getting There Faster: Benchmarking Math Chip Versus Compiler

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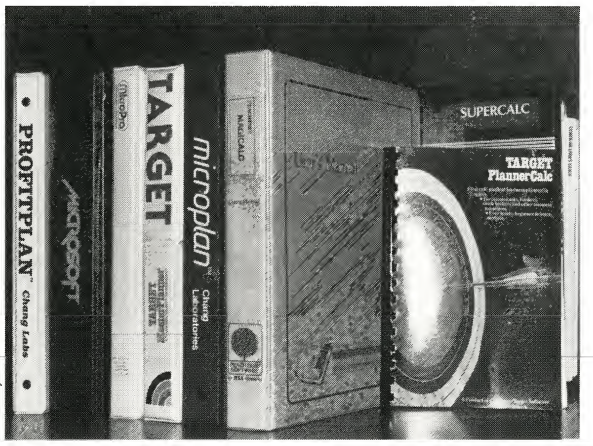


Photo by Kenneth Patrick

If you've ever used a multi-column accounting sheet to help with routine bookkeeping, you know what they can be: simple, dull, tedious, and error-prone. If you've ever used similar forms to handle engineering or scientific data with dozens of formulas to be remembered, you know they can be complicated as well as dull, tedious, and error-prone. Do you only have to add and subtract? Or do you have to handle complex technical or accounting formulas? Either way, there are spreadsheet programs to let your Heath/Zenith computer do the work for you. They're reviewed here.

40

Features

HUGCON 1
Frederick Zimmerman 7

IMAGE: a Word and Picture Processor
Hal Glatzer 35

Word processing is old hat. And graphics programs have been around a while, too. But what about putting words and graphics together into one package? Then you'd be able to use words and graphics in the same document. How well would it work? A package to do it is what's reviewed here.

Eight Spreadsheets Compared: Charting Products to Eliminate Tedious Calculations
Kenneth A. Patrick 40

T & E associates: "Just Home Folks" Implementing HDOS Utilities
Frederick Zimmerman 57

A few years ago, some computer folks "fell in love with HDOS." They formed T & E associates and the Heath/Zenith marketplace hasn't been quite the same since then. But the Heath Disk Operating System, they assure us, has been left just the way they found it. Their utility software is sold with that assurance.

On a warm weekend in August, more than a thousand Heath/Zenith users travelled to Chicago. They talked, ate, and slept Heath/Zenith computers that weekend. While they were there, they saw products old and new from Heath/Zenith and the independent suppliers. Some contented themselves with "window shopping"; some had already planned on spending "too much" on purchases; and some were lucky enough to bring things home free, courtesy of Heath/Zenith and the independents. They all, though, got to meet people they'd only heard about or "talked" with on MicroNet. And they all seemed to regard the first National Heath Users' Group Conference as a prelude to still more in the future.

7

Photo by Charles Floto

Cover photos by Kenneth Patrick.

Issue No. 4, Winter 1983

Getting There Faster: Benchmarking Math Chip vs. Compiler
John C. Roos 62
Will a hardware change — putting in a math chip — give your computer the added speed you want? Or should you think about software — moving from BASIC to a faster language like FORTRAN? This article asks the question for the Heathkit/DEC model H11 computer. But the question and the method of answering it are equally applicable to those with H8s or H/Z89s.

Venturing Beyond the Heath/Zenith Disk Controller
James A. Pilarski 67

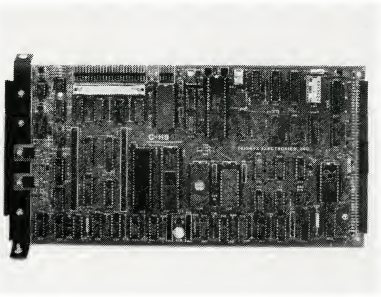
A Survey of Disk Controller Alternatives
Frederick Zimmerman 74

Interrupt Programming Under HDOS
Aaron Reynolds 78
Computers are expected to do more than one thing at a time. Since they can't, they have to fake it. Jobs have to be chopped up into little pieces and the computer jumps from one piece of one job to another piece of another job — fast enough so the user doesn't see the footwork. The footwork—making sure all the little pieces are kept separate—is interrupt programming. Care to give it a try?

Coming Attraction: the Heath/Zenith Community Goes to the Faire
John Walker 92

Departments

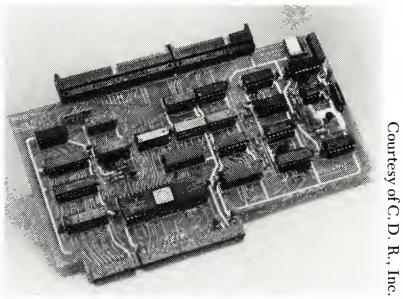
The Editorial Eye	3
Letters	3
Index to Advertisers	70
Supplier Notes	89
Classified	90
Luminaries	90



Courtesy of Trionyx Electronics Corp.

74

If you want to add disk drives, you have to have a disk controller board to handle them. There are a number of boards out there, and here's a survey of suppliers and their products to help you take a look at the market.



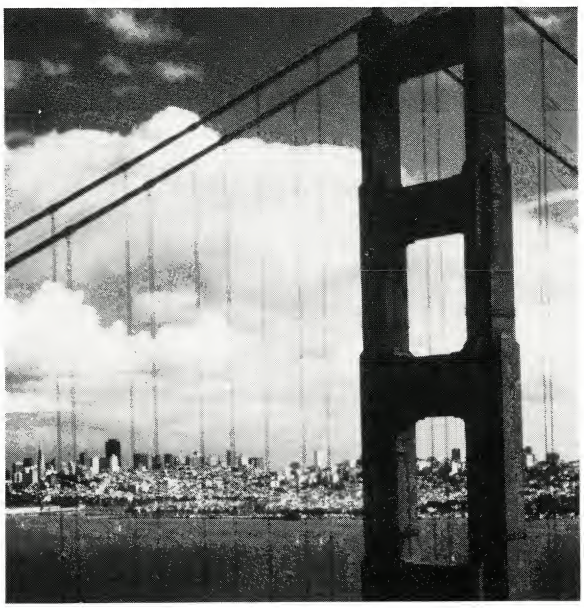
Courtesy of C. D. R., Inc.

67

Why bother? And what might you be on the lookout for? Why not just stick with the Heath Company products? Well, in a review of C. D. R.'s offering, those are the questions that are considered. And C. D. R.'s board is judged in the light of the answers.

If early Winter's here, can late Winter be far behind? Yes, it's getting close to that time of year again. Soon, the snows will retreat. Winter's icy grip will be broken by the passage of time and the earth's ever renewing impulse for life and growth. Though it still looks cold and drear now, hope and joy and new beginnings are almost at our very doorstep. There's no snow in San Francisco, anyway. Yes, it's nearing March and the Eighth West Coast Computer Faire.

92



Courtesy of S. F. Visitors Bureau, photo by Sandor Balatoni

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The Editorial Eye

How are we doing? With publication of this Winter 1983 issue, *Sextant* completes its first year as "The Independent Magazine for the Entire Zenith Computer Community." As usual, we're interested in your comments on the articles in the issue. Opposite page 70 there's a postage-paid card you can use to send them along to us. Knowing which articles you find interesting, useful, and applicable to your system helps us plan what to publish in the future. For example, the chart comparing disk controllers from six independent suppliers (pages 74-77) is a direct result of reader requests for this information.

We also appreciate communications longer than can fit on a Reader Service Card. Some of these letters we've received recently are published below.

As I write this, we're in the process of soliciting another form of reader reaction to *Sextant* — we're sending out about 4,800 renewal notices to subscribers who have been receiving the magazine since its first issue. The number of them who respond with a check or credit card charge will provide the most broad-based test of our performance. Opposite page 22 there's a card you can use to extend—or start—your own subscription. Current subscribers can find their "last issue" numbers on the far right of the top line of their address labels. (This may not reflect renewals received within the past month.)

So telling us you like what we're doing is easy—just send money. If you're not so happy with us, please take the extra effort to let us know why.

Letters

Received *Sextant* #3 yesterday and would like to supply some missed information for Ray Albrektson's article [*Sextant*, Fall 1982]. Anyone who changes U518 to a PN:444-84 ROM also has to change U516 Secondary Address Decoder ROM to a PN:444-83, since it is a 4K ROM. The earlier two 444-62 and 444-40 are 2K ROMs and use a secondary decoder U516 PN:444-41. Also, to use the 4K 444-84 ROM four jumpers must be changed on the CPU board. The SW501 positions 0, 1, 2, and 3 are redefined from previous definitions. The needed information can be found in the PN:597-2571-01 "H88/H89/Z89/Z90 Configuration Guide" and probably in various other manuals. I hope that this information might be of some help to someone who decides to upgrade an earlier version computer.

Brian L. Hansen
Killingworth, CT

I certainly enjoy your publications, and look forward to receiving them. I have had an H89 for nearly a year. I use HDOS and CP/M, and I write programs in MBASIC, assembly, and C. I have recently started doing some work with Dave Murry, so you may run into my name in connection with Evryware from time to time.

I was particularly taken with a comment in your first issue [Spring 1982] of *Sextant* concerning your advertisers, and their "ability to believe six impossible things before breakfast. . . ." I've been practicing, as I believe this is a very important talent to have if one is to succeed in this line of endeavor. . . .

Maureen Hackley
Portland, OR

Re: "The World's Fastest Sort?", R. Lutowski, *Sextant*, Fall 1982.

Upon reading the referenced article, I immediately reached for my copy of *Sorting and Searching* by Donald E. Knuth (Addison-Wesley, 1973). It is volume 3 in his series "The Art of Computer Programming," which has become recognized as the most comprehensive work on the subject to date. Not surprisingly, I found the "address" sort (in fact, several versions of it) treated there. On pages 170-178 this algorithm is discussed and illustrated with the same playing-card example used by

Mr. Lutowski. The only visible difference is that Knuth generally refers to the method as "radix sorting."

Mr. Lutowski was entirely correct in noting the significant age of the algorithm. According to Knuth, "The first published reference to this principle for sorting appears in L. J. Comrie's early discussion of punched-card equipment [*Transaction of the Office Machinery Users' Assoc., Ltd.* (1929), 25-37, esp. p. 28]." He goes on to cite several references dealing with implementation of radix sorting on digital computers: "H. H. Seward [Master's thesis, M.I.T. Digital Computer Laboratory Report R-232 (Cambridge, Mass.: 1954), 25-28], . . . Friend [*JACM* 3 (1956), 151], . . . M. D. MacLaren [*JACM* 13 (1966), 404-411]."

The point I'm trying to make is this: neither the algorithm *nor its implementation on digital computers* is new. While Mr. Aughey might have independently discovered its utility, it does not appear that he should be credited with originating the idea. Furthermore, radix sorting has been fairly well studied and has *not* been "missed" by the "computing geniuses of our day."

I am a rabid Heath fan, subscribed to *Sextant* immediately upon learning of its existence, and have recommended it highly to several of my friends. However, I think that your otherwise excellent work as editor was significantly tarnished by the publication of this article. My advice to any editor who receives an article espousing some "revolutionary" new idea is to adopt a healthy skepticism and do at least a cursory literature search of works by recognized authorities to ensure that the idea really is new and not just a rewrite of something known commonly to experts if not to novices/hobbyists/amateurs. This is not to say that you should not publish articles that give a lucid explanation of useful ideas, new or old. You should just make sure that you do not publish misrepresentations, however innocent they may be.

J. R. Frost
Monterey, CA

I personally did not infer claims of novelty and uniqueness for what was described as "probably the oldest sort known, as well as the most widely used." To me, "revolutionary" implies a return to an earlier position–as in the revolution of the earth around the sun, or the American Revolution fought to reestablish rights guaranteed under British common law.

I realize there may be many interpretations of what constitutes "our day." My own inclination is to think of it as starting in 1977, with the introduction of the H8, the TRS-80, and the Commodore PET. Thus, on page 109 of the Summer issue, I referred to 1975 as "those thrilling days of yesteryear."

I published the article as a vendor's explanation of the design of a product for users of the Heath Disk Operating System. While I am not aware of any other commercial implementation of the sorting technique discussed, I had no illusions of breaking new theoretical ground with the publication of the Fall issue.

[Re: "The World's Fastest Sort," *Sextant*, Fall 1982], the "C" in the third equation, right hand side of page 40, should be a left parenthesis and the bubble sort was improperly described on page 35. The phrase "next largest record" should be changed to "next smallest record."

The "address sort" is described in four sources that I am aware of: *Data Structures* by M. Elson (Chapter 8 — distribution sort), *The Design and Analysis of Computer Algorithms* by A. Aho, J. Hopcroft, and J. Ullman (Chapter 3 — radix sort), *Data Structures and Algorithms* also by Aho, Hopcroft and Ullman (Chapter 8 — radix or bin sort), and *The Art of Computer Programming* by D. Knuth (Chapter 5—radix sort).

It has been proven (*Design and Analysis* . . . — Chapter 3) that to sort n records *by comparisons*, it takes at least a number of comparisons proportional to $n \log_2 n$, for n sufficiently large. The "address sort" does not compare keys and in fact does not even use the entire key during any one step and so is not subject to this result.

Jamie Adams
Falls Church, VA

I can't believe Ken Patrick didn't review or *even mention* T-Maker II (Lifeboat) [*Sextant*, Winter 1983]. It is beautiful!! I think the omission is worthy of editorial comment.

Charlie Corbin
Northfield, MN

While one expects a high level of technical expertise from users of Heathkit computers, you can imagine my surprise on discovering "The World's Fastest Sort" in your Fall 1982 issue. However the article is misleading, and I would like to correct some of its inaccuracies.

1. How fast is "the world's fastest sort"? A casual reader looking at the article might conclude that the sort is very fast from the table on p. 46. Unfortunately, although the table is labeled "Sort time, Seconds," the author did not actually write FORTRAN programs for the Quicksort and Bubble sorts; he appears to have adjusted the times of some sorting programs written in BASIC published in *Kilobaud*. It is always difficult to compare programs written in BASIC, an interpreted language, with programs compiled from FORTRAN. I actually wrote some FORTRAN programs to sort using several algorithms, and have included the results. In addition, the "Sort Time, Seconds" for the ADSORT are also hypothetical, based on linear extrapolation using the numbers from the table on p. 44. It is easy to show that sort times increase linearly when a formula is used to calculate the times rather than an actual test.

How fast are the various algorithms when similar programs are written and compiled with FORTRAN? I copied three sorting subroutines from the book *Software Tools*, by Kerninghan and Plauger. They describe quicksort, shellsort and bubblesort. I then coded the author's algorithm, using a description published by Knuth (*Sorting and Searching*, pp. 78-80). (I was surprised to see the ADSORT algorithm, which had not been considered until Mike Aughey, was the *second* algorithm described in Knuth's classic text.) The programs were written in RATFOR, translated to FORTRAN and then compiled. Times were taken on a 4 MHz H89. In each case, except as noted, I generated 10,000 random integers and sorted M groups of N, e.g. 1000 groups of 10 integers, 100 groups of 100, to the 10,000 numbers in one group. Because the ADSORT algorithm does not actually sort the numbers but instead calculates index pointers I sorted the same 10, 100, 1000, or 5000 records M times.

Seconds required to N records M times:

SORT				
# records	10	100	1000	10,000
# times	1000	100	10	1
ADSORT	99	18	9	9[1]
Quicksort	8	12	16	21
Shellsort	8	19	34	54
Bubblesort	8	88	880[2]	8800[3]

[1] Due to the memory requirements of ADSORT, only 5000 records were sorted twice.

[2] 1000 records were actually sorted twice in 176 sec.

[3] This value is calculated from the N*N time required by Bubblesort.

This table makes several points. 1. ADSORT is very fast, if you are sorting a large number of records on a microprocessor. It is very slow for a small number of records, because the sorting algorithm must go through the 256 address values twice even though there are fewer than 256 records. 2. Bubblesort is very slow. Although the author says "These results clearly show that the crossover point lies below 10 records," he is clearly mistaken. To draw a conclusion, one must do the test. The crossover point for 16-bit integers is in fact at 256 records.

One of the most remarkable properties of ADSORT is that the sorting time/record actually decreases as the number of records increases. This is because of the overhead involved in calculating address values. To examine this further, I used ADSORT and Quicksort to sort groups of 32-bit integers (requiring 4 passes through the addresses). ADSORT took 193 seconds to sort 5 records 1000 times, compared to 7 seconds for Quicksort. 50 records*100 took 32 and 13 seconds respectively, but 5000 records took only 12.5 seconds for ADSORT compared to 29 seconds for Quicksort.

It should be noted that one of the reasons ADSORT is faster for large numbers of records is that the table lookup address calculations are much faster on a microcomputer than even simple integer

comparisons. On a 16-bit machine, which can do an integer comparison with one instruction, the crossover point between ADSORT and Quicksort would be shifted to larger numbers of records. Having a 16-bit machine does not help ADSORT much, beyond providing more memory space for pointers.

2. When should you use ADSORT? Knuth addresses this question in some detail in his book. Basically, ADSORT is great if you have a large number of *fixed length* records. Variable-length strings are death to ADSORT, because one must pass through each of the strings M times, where M is the length of the longest string, even though most string comparisons would be done in one or two bytes. ADSORT is great for ZIP codes, but not good for names and addresses.

My investigation into ADSORT was not without its compensation, however. In the process, I discovered an algorithm to reorder an array given a set of index pointers in linear time. Naturally it was provided by Knuth, who reports it was originally described in 1967. (Note that the ADSORT algorithm, called a Distribution sort by Knuth, was first published in 1954 and again under the name Mathsort in 1960). I also tested ADSORT using the reordering algorithm and found reordering the data (and thus saving an index array) did not increase execution time by more than 10%.

As a final note, we all have much to learn from computers, and look to magazines like yours to guide us. While theoretical discussions are valuable, when an author makes a claim about an algorithm, he should present facts, not hypothetical calculations. Computers are good for generating data so that we don't have to guess.

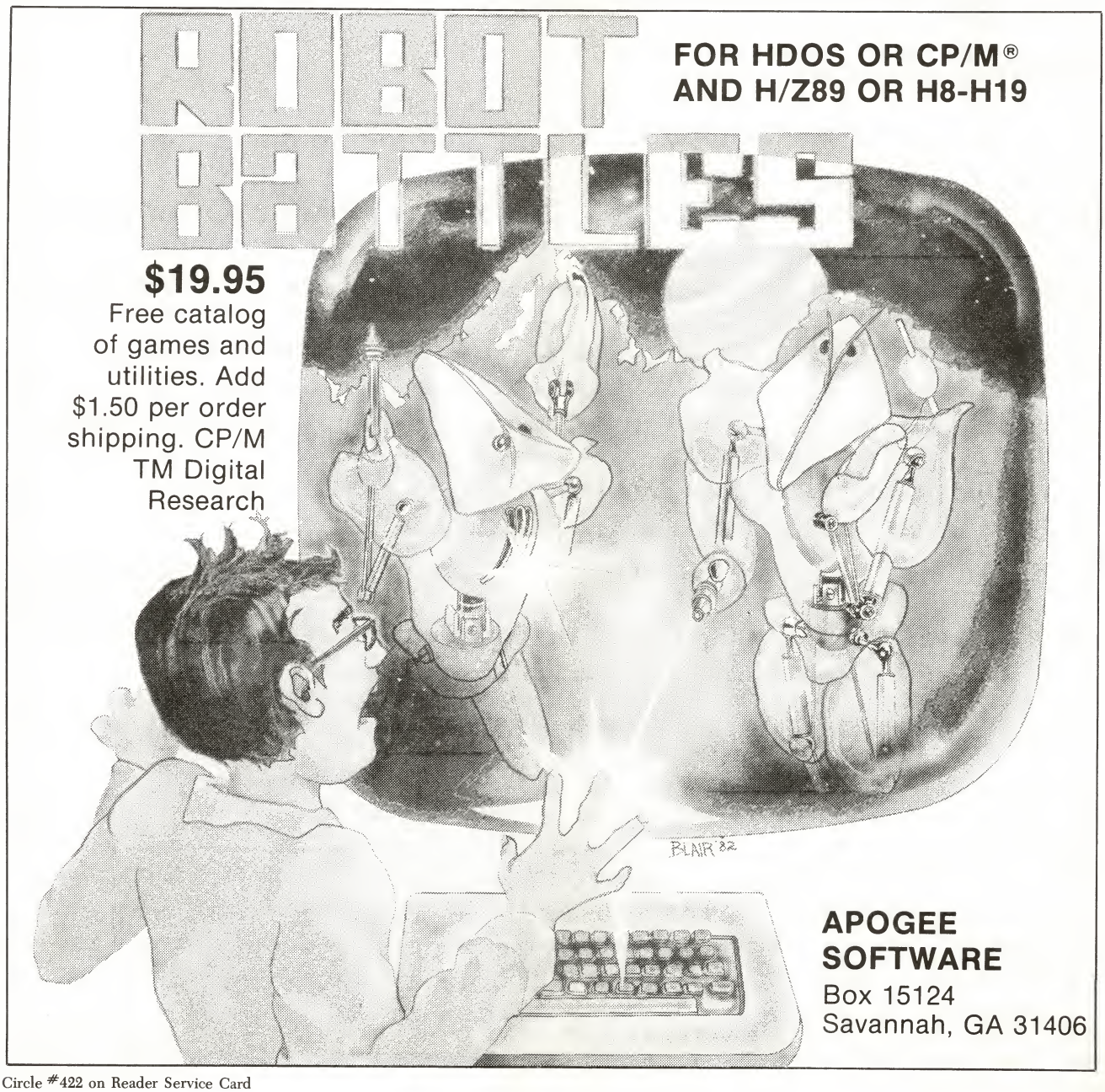
William R. Pearson
Baltimore, MD

I have always suspected that the results of mixing movers and computers could be tragic. Mr. Esche [*Sextant*, Summer 1982] has confirmed my worst fears. Each time we move, the components of the computer system are lovingly packed, along with the family china and anything else considered important and breakable. We then transport our precious cargo ourselves. A small trailer is rented for the purpose. This has caused us little inconvenience — we have had to drive the car there once anyway — but, apparently, it has saved us considerable grief. I would recommend this procedure, if possible, to everyone.

John P. Jeter
Lafayette, LA

A pro writer recommending PIE? [*Sextant*, Spring, Fall 1982] I still haven't gotten over that one yet. Use more discretion in choosing what to print! Sure, I could ride a bicycle from Wisconsin to D.C., but a plane would be the logical choice!

H. Fale
Sheboygan, WI



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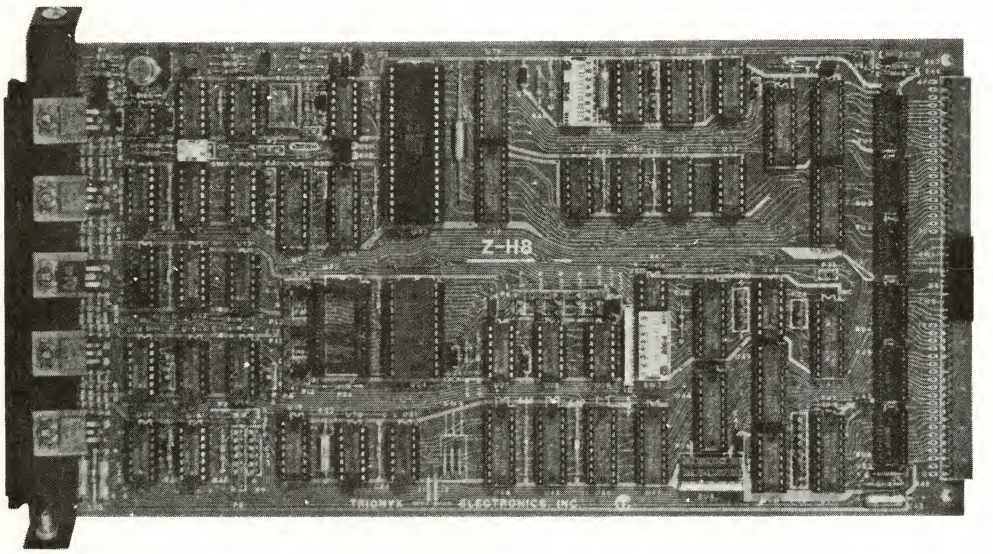

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Frederick Zimmerman

"I can assure you, ladies and gentlemen, that there will be many, many more buttons to push five, six, or seven years from now than there are today. We don't know what they are, but I can assure you that this company has the design ideas, enthusiasm, and engineering to bring you these products at a price you can afford. Thank you." With these words William E. Johnson, president of the Heath Company, concluded the opening speech of the first National Heath Users' Group (HUG) Conference, which was held August 6, 7, and 8 at the Hyatt Regency O'Hare outside Chicago, Illinois.

Mr. Johnson's words summarize the spirit which inspired the conference. About one thousand members of the national HUG came to Chicago because they shared a strong mutual interest in "pushing buttons." In other words, they wanted to join other Heath/Zenith computer users in checking out the crowded exhibition hall; or in hearing a series of high-powered speakers explain some of the more sophisticated features of Heath/Zenith systems; or in enjoying the sights of Chicago. HUG's busy, well organized conference gave HUG members plenty of buttons to push: I did not once step outside of the hotel, from the moment I arrived — Friday before lunch — to the moment I left — Sunday after dinner. I was immersed in the separate world of the HUG Conference. If the remarks of fellow conferees on the shuttle back to the airport are to be accepted as sufficient evidence, I was not the only one who found it rather difficult to adjust to the existence of an outside world with potholes and non-HUGgies.

Inside the Hyatt Regency O'Hare

A sense of total immersion is a mark of a well planned conference. The Heath Users' Group organization did a fine job of putting the conference together. For example, they chose a location which worked out well. The Hyatt Regency O'Hare's proximity to Zenith Data Systems (ZDS) in suburban Chicago and Heath in St. Joseph, Michigan, made it easy for the stars of Zenith and Heath top management to come to the conference. Two other sites were given some consideration: San Francisco and Denver. However, Chicago was more central than San Francisco (which wasn't hard), and more cosmopolitan than Denver (ditto), two facts which probably increased the turnout of HUG members from the East Coast.

Photo by Charles Floto

The independent suppliers and their products in the exhibit hall were a prime attraction.

The physical facilities — bedrooms, conference areas, swimming pool, rotating rooftop lounge, eight-story atrium, glass elevators, etc. — were adequate. The hotel's service staff was well trained and capable. Even better, the food at the restaurant was good, and, perhaps more to the point, the prices were quite reasonable. I paid $6 to $10 for entrees, and $7 for an all-you-can-eat salad bar with fresh whole fruit, various deli meats, and two flavors of soft ice cream. I enjoyed my stay.

My enjoyment was facilitated by the fact that I personally paid for very little while I was there, since I was on expense account for *Sextant*. But HUG members who were paying their own way got some good deals, too. Donald P. Moffet, president of Zenith Data Systems, picked up the tab for the catered Saturday evening dinner: $23,778, including a $3,000 gratuity. Joseph M. Schulte — president of Veritechnology Electronics Corporation, which owns the Heathkit Electronic Centers — paid for Saturday lunch. The tab came to about $12,500, including a $1,634 tip. I'm sure I speak for everyone at the conference when I say that this generosity was much appreciated.

Keep them busy — and out of trouble

Another sign of a well planned conference is a

full agenda. If you were foolhardy enough to go to every event on the schedule, you could enjoy up to 13 hours a day of Heath/Zenith action, either in the surprisingly crowded meeting room or in the busy exhibition hall. Speakers included Bill Johnson, president of Heath; J. Gordon Letwin, author of the Heath Disk Operating System (HDOS); Don Moffet, president of Zenith Data Systems; Bill Johnson, an inhabitant not of Benton Harbor but of Manassas, Virginia, who is a founding member of the world's largest local HUG group, the Capital Heath Users' Group of the Washington, D.C., area; and many other interesting people from the Heath/Zenith community.

He sent out 500 mimeographed flyers offering an oscilloscope kit for $39.95. He received back 350 orders with cash, which gave him the money to hire people to ship the products he had promised.

I'll just mention a few of the many outstanding exhibitors, to give you an idea of who was there. Some of the "high-tech" vendors included: Walt Bilofsky of Software Toolworks; Reuel Launey of Artra, Inc., who demonstrated an impressive Housemaster house control system; Peter Botten of Cleveland Codonics, with an Imaginator graphics board for the H/Z19; Magnolia Microsystems, with a 5.25" hard disk drive hooked up to a Z89; Heath/Zenith, with super bargains on the H89 and other products, as well as some fancy demonstrations of the Z100 machine's graphics capability; *Buss* and *Sextant*, manning a rather "low-tech" wooden table; and many other fine companies with products aimed directly at the Heath/Zenith computer user.

I was impressed with the punctuality which HUG officials — and particularly master of ceremonies Jim Blake (:JB:) — managed to impose on the energetic conferees. The speeches generally ended on time, thanks, it was implied, to some emphatic instructions from *someone*. Walt Gillespie, the new editor of *REMark*, hustled everyone out of the exhibition hall promptly at the scheduled time each evening. The buyers were generally reluctant to leave, but the vendors were somewhat more willing — by the end of each day, they were ready to drop where they stood. I was grateful to Blake and Gillespie because their punctuality minimized the amount of time I had to "hurry-up-and-wait," an activity which I regard as an especially loathsome double inducement to the deadly sins of Anger and Sloth. The conferees benefitted from HUG's strict adherence to schedule, since it enabled them to plan their time without having to allow for boring and inefficient delays.

Origins of the Conference

Where did this professionally organized conference get started? One might expect that it was in some mahogany-lined conference room on the top floor of Zenith Data Systems headquarters. Not so: the first National Heath Users' Group Conference originated in St. Louis. Several people who have been active on MicroNet's HUG bulletin board decided to go to the regular St. Louis club meeting and make it a regional event. That went very well, so software developer Bill Parrott suggested to the national Heath Users' Group that a national conference might be a good idea. They picked up on this idea immediately, and swiftly won the approval of ZDS management. After months of hard work by the HUG team, the familiar "beep-beep" of the H89 was heard throughout the meeting hall of the Hyatt Regency O'Hare. Bob Ellerton, manager of HUG, officially declared the first National Heath Users' Group Conference "up and running" at 8:30 Saturday morning, August 7.

Friday evening

Unofficially, however, the conference had been going strong since 7 p.m. the preceding evening. More people showed up Friday than HUG officials had anticipated, and many of them were milling around in the lobby that evening with nothing scheduled for them to do. The vendors agreed, on very short notice, to open the exhibition hall a day early. At 6:15, Walt Gillespie held a meeting and said, "Unless there's any objection, we'll open up at seven." One of the most prominent exhibitors present explained later, in *Sextant*'s Washington offices, that "no one had enough nerve to object." Although there was some grumbling from "three of the industry's largest firms," the exhibition hall opened at seven, and the vendors did good business. Many of them had put aside eagerly anticipated plans for dinner in Chicago, so by the time the exhibition hall closed at 10:00 many vendors were ravenously hungry. One group went to Ventana's at the top of the Hyatt Regency, billed in lobby advertisements and even on the elevator buttons as a "restaurant/lounge," only to discover that Ventana's didn't serve dinner. Fortunately, the Hyatt's *real* restaurant had late hours and good food, so Walt Bilofsky of The Software Toolworks didn't have to make good on his threat to have a pizza delivered to his room.

Saturday morning

Bob Ellerton began the conference proceedings by introducing Bill Johnson, president of the Heath Company. Johnson hastened to warn the conferees that it hadn't been *his* idea to give a

speech — he'd been tricked into it. "Bob Ellerton called up and said, 'Bill, do you believe in free speech?' I said, 'Sure!' He said, 'Great! How'd you like to give one at the National HUG Conference?' " Despite Johnson's warning, he turned out to be an entertaining and informative speaker.

He started off by giving some history of the Heath Company. The Heath Aircraft Company began with Ed Heath, whom Johnson described as "a little runt of a guy" who "was always hanging around airports when he was growing up," dreaming to "design and build his own airplanes." In 1927 he offered his first aircraft for sale, the Parasol. This plane, with a 12-foot wingspan, sold for $699 in kit form. But if you didn't have $699, he'd sell you *some* of the parts for a lower price. "Ed Heath was a merchandiser from the very, very beginning."

Unfortunately, when Ed Heath died in a crash while leading an air race in 1931, there was no one left who knew how to run the company, and the Heath Aircraft Company closed its doors and went into bankruptcy in 1933. A man named Howard Anthony bought the name of the Heath Aircraft Company in 1935 for $700, moved to Benton Harbor, Michigan, and began selling aircraft parts. He had only moderate success initially; for the first few years he was "struggling along with three or four or five employees." All that changed in 1941.

Shortly after America declared war he got a phone call from Washington, D.C.. They asked him, "Are you an active aircraft company?" He replied, "Certainly." He had to borrow money to make the train trip to Washington. He came back with a big contract to make parts for light trainer aircraft: windshields, pontoons, and so on.

The Heath Company grew to 125 employees by 1947. Then all its government contracts were cancelled, and the company went from 125 to five employees within six months.

Howard Anthony was sitting in his office later in 1947 when he got a call from a firm by the name of Newark Electronics. The conversation went something like this: "Howard, I've got some surplus government electronic parts. Do you want to be cut in?" He said "Sure." Some weeks later, after he had forgotten all about the electronic parts, five carloads of government surplus arrived at the Benton Harbor railroad station, and Anthony got a call from the railroad, informing him that he owed $38,000 for shipping. "Howard Anthony had no idea what was going on, or what was in those carloads." He borrowed half the money from his bank and half from his friends. Then he took inventory.

He discovered that he had purchased, among other things, 30,000 5-inch CRTs worth $65 to $70 in wartime. They were brand new. And there were many, many other parts, also all new. Anthony looked at his inventory and said to himself, "It doesn't take much to make an oscilloscope." He had all the parts right there. He sent out 500 mimeographed flyers offering an oscilloscope kit for $39.95. He received back 350 orders with cash, which gave him the money to hire people to ship the products he had promised.

By 1954, the company was doing $10 million in annual sales, "still working off those original parts." By then Anthony had invested in the largest natural gas deposit in Michigan, was making a good deal of money, and "was having a great time." That year he became Heath's second chief executive to "expire" in an air crash. Current Heath President Bill Johnson said dryly: "I drove here today."

Mrs. Helen Anthony had been involved in the company (unlike Ed Heath's widow), and she kept

Photo by Charles Floto

Some registered late when the lines in the lobby of the Hyatt Regency O'Hare were shortest. Some people registered early and came back to refuel with coffee and doughnuts.

the company going. In 1955 she sold it to Daystrom, which owned Heath from 1955 to 1962. The Heath Company seems to have done well under Daystrom's management.

Then, in 1962, "a very good thing happened to the company: Daystrom sold [it] to Schlumberger," a large multinational corporation in the oil-exploration support business. (That's pronounced Schlum-bair-zhay.) Johnson described Heath's relationship with Schlumberger as a happy one, although as the only consumer-oriented company in the Schlumberger group, Heath was something of an anomaly. The relationship was sufficiently amicable for Johnson to say, "We still go into our cafeteria and order ham-bair-zhays."

In 1979, the Zenith Radio Corporation bought Heath from Schlumberger. Johnson explained why, as president of Heath, he sees this as a good thing: "Zenith's investment in the company has been greater than that of any prior ownership by a factor of four."

Jerry Pearlman followed Johnson to the speakers' podium. He was the Zenith executive respon-

sible for the purchase of Heath, and he's now in charge of overseeing the operations of Zenith's computer group. He offered another perspective on Zenith's courtship of Heath: "Three years later, are we still in love?"

Pearlman pointed out that Heath and Zenith share many common values: "commitment to quality," "technical electronic design skills," and "consumer franchises with high brand awareness." Pearlman noted that "the request for the ZDS

"Zenith's investment in the company has been greater than that of any prior ownership by a factor of four."

name [on the Z89 and other products] did not come from Zenith, it came from senior Heath management, in order to connote quality *assembled* products." That is an important piece of evidence to support Pearlman's contention that "the two companies fit remarkably well." Another piece of evidence Pearlman presented was that the two companies had cooperated on the new color video monitor: "Heath did the outside, Zenith Radio Corporation did the inside."

"We've also been proving our love with our checkbook," Pearlman reported — which, he noted, is not an uncommon practice in other courtships. "[S]ince acquisition, we have added more than 100 people to hardware and software engineering ... we have invested literally millions of dollars in new production facilities." Pearlman concluded with warmth, if not syntactical perfection: "The computer business very uniquely has our special affection."

A brief encounter with Veritechnology

Joe Schulte is president of Veritechnology Electronics Corporation, which is the company which owns the Heathkit Electronic Centers (HECs). He gave the next speech. He emphasized several key points: "in every location where we have a store, there is a warm and amicable relationship between the HECs and HUGs.... Each store usually dedicates some hardware to the local bulletin board system.... Heath stores appreciate the support the clubs offer potential customers...." He concluded: "Veritechnology will continue to work with you to enhance in every way possible your investment in our equipment."

(For more perspectives on the relationship between Heathkit Electronic Centers and Heath Users' Groups, see the upcoming Spring 1983 issue of *Sextant*.)

Software development news

The final speaker Saturday morning was Thomas Dornback, vice president for software development of Zenith Data Systems (ZDS). He provided some interesting information about Zenith's software operations, and in general I think his audience regarded him as a worthwhile speaker. However, he struck an irritating note which persisted throughout the conference: as a matter of Zenith policy, he would not answer any questions about future products. I thought Dornback was somewhat more hard-nosed in adhering to this policy than were some of the speakers who followed him.

Dornback did provide information about his ZDS software development division — in some detail. He told us that he supervises four groups: 1) Operating Systems, Languages, and Utilities, headed by Ron Kasik in St. Joseph, Michigan; 2) Applications Software, Gary Bauman, Chicago; 3) Chicago Quality Assurance, Lynn Stanczuk; and 4) Software Customer Service, Skip Gwyer, St. Joseph.

"Zenith Data Systems' basic strategy is to acquire software from outside professional developers," Dornback confided. "We use our staff to add a unique Zenith touch to each product."

Dornback's audience contained many software professionals who might sell programs to ZDS, and he took care to address their interests. He listed some Zenith Data Systems software requirements: products must "be completely tested," "be well documented," "be full-functioned," "have extensive error-handling capability," and also "use the unique features of Heath/Zenith hardware." He posed himself the question, "What makes for a good relationship with Heath/Zenith software development?" He answered by naming four qualities: "honesty, responsiveness, flexibility, and confidentiality." He said, "We are anxious to expand our line. We're interested in any kind of high-quality 8-bit and 16-bit programs."

How does Zenith add "a unique touch" to its software? In other words, what is the process whereby a product goes from the author to the marketplace? Zenith Data Systems is constantly looking for programs to fill various niches in its product line. Dornback said, "We test as many products as possible, and commit to one. Then the work really begins."

First, the Zenith staff looks at the program's documentation and begins the time-consuming chore of bringing it into line with other Zenith software. Then "a small group of internal people ... with a pathological desire to find flaws ... cross-checks the other group's previous work." The people at Chicago Quality Assurance try to put themselves in the place of the customer. "They sometimes insist on changes, and if that

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happens, the product goes back to the top of the loop." When the product passes Chicago "QA" testing, "it goes to St. Joseph, Michigan, for typesetting, editing, layout, and St. Joe's QA test." Next, the disks are manufactured and the manual is printed. The manufactured product undergoes a final test called the "Line Proof." After that, the programs are shipped to the customer.

Dornback said "This process has been in place for about a year." It is a lengthy process, and

"What happened to HDOS 3.0?" one HUG member asked.

Dornback acknowledged that "there is no easy way to keep them from out-versioning us." He admitted that sometimes California manufacturers have released version 4.0 of a product while Zenith is still working on version 2.0, and Zenith has to say "We're testing them, you can't have them." He said "that problem causes a lot of personal pain for me and my colleagues here," but appeared to believe that the length of the software development process was a necessary consequence of the Heath/Zenith corporate philosophy of quality assurance.

Z100 software

Dornback described the software which is initially available with the new Z100 series of microcomputers: the Zenith Disk Operating System (ZDOS); ZBASIC; CP/M-85; BASIC-80; Multiplan, a "third-generation" spreadsheet program; and an Interactive Business Graphics package provided on a demonstration diskette.

(Later that afternoon Barry Watzman, computer product line manager, told his audience that the prices for the programs would be from $150 to $250. The total price of the products listed above would be $900. However, Zenith is offering a package deal which makes the cost $500.)

Dornback also praised Zenith's new documentation format. He credited Dr. Larry Hartman with bringing the idea to the ZDS staff when he joined several months ago. Hartman's ideas make sense. In the new format there is a synopsis at the top of each chapter. Key words are put in **bold face**, and there are phrases in the margin which help you find information on the page. Each new manual has glossaries and comprehensive indexes. These steps will help Zenith improve its high standards of documentation quality.

(*Sextant* readers will find a review of the Z100 Users' Manual in issue #3, Fall 1982.)

Dornback answers (some) questions

"What happened to HDOS 3.0?" one HUG member asked. Dornback replied, "We're not permitted, encouraged, or allowed to talk about future products. HDOS 3.0 is a future product." This announcement drew a chorus of disbelieving groans. Zenith's policy frustrated HUGgies throughout the conference, as Dornback and the other speakers maintained their cautious silence. All that they would say was that HDOS 3.0 was "on the way."

One rumor which circulated at the conference suggested that ZDS had clamped down the lid in response to a recent story in the *Chicago Tribune*, in which there was a bit too much information about future Zenith products. However, Mike Brenner — ZDS product line manager for terminals, video monitors, and applications software — told me after the conference that the reason for the silence policy was that Zenith did not want its customers ordering its products before they were ready to be shipped. That makes a lot of sense to me; such a situation serves no one's best interest.

One questioner asked Dornback, "What are you doing with diagnostic software?" He was able to give an answer straight from the horse's mouth. "The issue has reached the highest levels of the company and has received vigorous discussion in the last 72 hours." If, when analyzed, this turns out to be rather a vague answer, that should be no surprise; after all, we *are* told never to look a gift horse in the mouth.

HUG members raised several other subjects in the Q & A session. For example, one asked "Will

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there be a UNIX-type operating system for the Z100?" referring to the trendy operating system developed by Bell Labs. Dornback said, "We don't discuss future products."

At one point, Dornback said that the Z100 users' manual will *not* be be sold separately. The manual was apparently the only place to find out whether or not your '89 software will run on the Z100 machines. So, an astute follow-up question several minutes later seemed to leave Dornback somewhat nonplussed. "If the manual won't be sold separately, how does one find out what 8-bit software will run on the Z100 series without buying a Z100 machine?"

"Good question," Dornback said.

After a moment's consideration, he said, essentially, that Zenith would make sure that information was published, free, *somewhere*. Shortly after the conference, Ray Massa of The Keyboard Studio put the information on the HUG bulletin board.

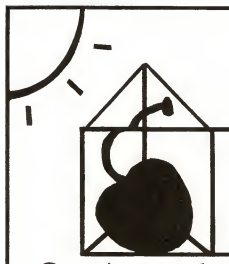
"Who do you think the biggest customers are for the Z100 series computers?" was the last question asked of Dornback. This pitch was a hanging curve, and Dornback knocked it out of the park. It may be that the person who asked the question was trying to imply that the Z100 machine isn't sufficiently hobbyist-oriented. If this was the case, the questioner's curve failed to break: Dornback made no such inference. He stepped back from the podium a bit, regarded his audience of several hundred HUGgies, and said, with perhaps more drama than candor, "I'm looking at them."

Saturday afternoon

Barry Watzman, Heath/Zenith computer product line manager, spoke at 1:45. He reviewed the history and design of the Z100 series for his eager audience. "The Z100 program began in earnest in March 1981 in response to some needs the Z89 couldn't meet: a faster processor, better support for graphics," more than 64K of inboard memory, "the ability to support multi-user and multi-task operating systems, and bus expandability."

Watzman said that Zenith did consider designing an enhanced version of the '89. However, they decided that "the effort needed to do that would have been close to the effort needed to do a new machine, and we didn't have the resources to do both tasks."

He also discussed the question of whether some other 8-bit coprocessor might have been preferable to the 8085 used on the Z100s. "We did consider the Z80." The 8085, however, had some important advantages. "The 8088 and 8085 are very close in hardware," Watzman pointed out, whereas "to use the Z80 would have required a substantial amount of additional hardware ... 12-15 additional ICs." Adding 12-15 integrated circuits was not in itself especially significant, since the



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total cost would only have been about $1. Watzman explained that "the biggest impact would have been in terms of PC board space." Printed circuits take up space, and there is a limit to how closely packed the chips on any board can be. The Z100 PC board was already crowded; indeed, to make it manufacturable, it was necessary to remove the chips which would have given the Z100 a capability to produce sound.

"If software can be regularly updated and versioned, why can't hardware?"

Watzman went on to mention some other aspects of the Z100 series hardware. He told his audience that the keyboard will send the central processor unit (CPU) "key down" and "key up" signals, a feature which enables a game programmer, for example, to determine how long a key has been held down. The keyboard is intelligent. The video display has "the most powerful graphics on the newest generation of micros," with three banks of video memory and a number of capabilities to enhance the system. The Z100 series can clear the video screen in 15-20 milliseconds. However, the video display speed of the Z100 is about the same as the '89, because "it's hard to move 144,000 pixels around the screen." The video board "provides a great deal of flexibility with regard to monitors."

(For more about monitors, see below: Mike Brenner gave a very informative talk about them on Sunday afternoon.)

Watzman said, "We've done quite a bit of work for the user's manual." This manual, unlike previous Heath/Zenith operation manuals, is aimed primarily at first-time users. "We've broken with tradition because our current end user market has been finding the current type of manual just about unusable." There will also be a technical manual for Z100 users. Barry Watzman told *Sextant* in early September that the TM would consist of three notebooks plus a bound firmware listing.

Watzman answers questions

"Why didn't you go to 96-tpi [track per inch] disks? Really," was the first question the HUG audience asked Barry Watzman in the question-and-answer session. He said, "Really?" paused, and continued: "On the '89 we'd have been better off with 320K and 48-tpi double-sided drives; 48-tpi offers a better mix of price to capability. The cost per byte for 96-tpi drives is not as good." He noted, "We also wanted to reduce the number of configurations because of ... problems involved in support...." He added that "The IBM machine is using 48-tpi disks. We wanted to be able to directly rewrite disks from IBM machines."

One questioner wanted to know, "Is it a coincidence that the UNIX manual is similar to the new documentation manual?"

"Yes."

Next question: "Why were there no provisions for implementing the 8089 and 8087 with the Z100?" Watzman said, "We have no real application for the 8089" input/output processor.... "It probably would have been better if the 8087 [arithmetic processor] had been implemented, but we have a way of dealing with that if the price of the 8087 comes down" to a point where demand might be significant.

"Has the H19 update ROM been dropped?" "No. That ROM will be available in September. We will turn it over to HUG. They will publish the source code on disk. I might add that, while all functions work and have been tested, the escape sequences are transparent, and some dangerous sequences can be gotten at much too easily. It's kit firmware, a new concept," he said, to appreciative laughter.

"Will any of the existing drives work with the '100?" Watzman: "Yes. Basically, they will ... you're on your own, it's unsupported, but it will work."

Watzman answered the next question by saying, "The Winchester drive issue is nebulous ...

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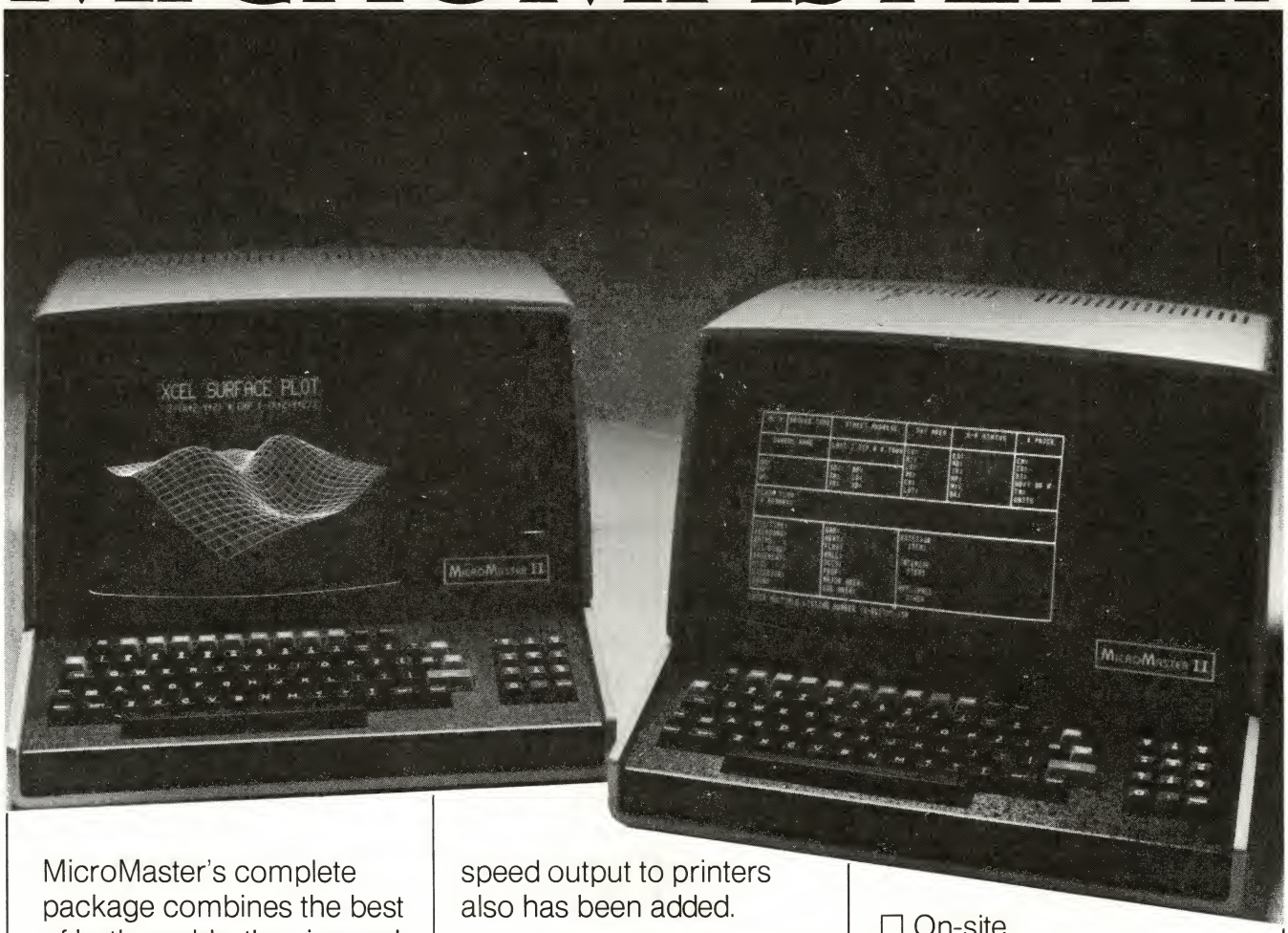

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don't make any assumptions about what we'll be offering."

One pugnacious HUGgie asked for "a comparison of the Z100 series, with the Victor 9000 series, relative to the Victor 9000's 800 by 400 pixel display and 1.2 megabytes of memory." (This tactless request was something like asking the groom for a comparison of the bride with her sister "relative to the sister's silky hair and beautiful cheekbones.") Watzman said, "Okay. I will attempt to answer the question, somewhat.... The Victor 9000 video display is black and white only.... [It] either has no expansion capability whatsoever or a non-standard bus, I'm not sure which.... It is true that the disk drives do have unusually large capability ... the reason is that they're not standard disk drives at all.... What they're doing is getting a constant data rate equal to the data entry rate from the innermost track, and I believe they're using an eighty-track drive.... Now I've gotten two different stories on how they're doing that; one is that the motor speed varies depending on which track the [head] is on...." The assembled HUGgies laughed wonderingly at this possibility. "...In any case, it's very non-standard, very complex ... other than that, they're basically very similar."

The next question was blunt: "Have you abandoned the people who bought 96-tpi drives?" Watzman stated his position straightforwardly. "The disk products currently on the market were sold for use with the Z89. You may elect to keep your '89, or you may choose to sell it. You bought those things to work with the Z89. If you sell it, the purchaser of the '89 will also have a need for peripherals and software. The assumption is that the system will remain basically intact." He closed the subject on this note.

"Why weren't ZDOS and ZBASIC included in the base price of the Z100 machine?" one HUGgie wanted to know. "Our original plan was to bundle the hardware and software," Watzman said. "We changed it to make our pricing seem more reasonable relative to the competition." When NEC and IBM unbundled their software, Zenith had to follow suit.

One man asked, "Does the Z100 have the capability for networking?" Watzman replied: "With the S100 bus obviously it does. We're going to have to provide networking in order to remain competitive."

One inquisitor — perhaps an inveterate hardware hacker — said, "If software can be regularly updated and versioned, why can't hardware?" Watzman explained, "We can't expect the customer to implement hardware updates." Hardware bugs frequently affect only a small percentage of users, in any case. "If he is having the problem, he'll go to the repair center, which has been notified" about all hardware bugs and the proper procedures for repairs.

"Can you give us a glimpse of the software products we'll see for the Z100?" Watzman said: "I'm going to pull the same thing Tom [Dornback] did...." But he did go so far as to hint, "We've spent about three years developing good software for the '89 series. We'll have similar functions for software for the Z100 series. It may take 6-12 months to get the Z100 to the level of current '89 software, though."

A lonely H11 fan asked Watzman for a comparison of the Z100 and the H11 16-bit Heathkit/DEC computer. As tactfully as possible, Watzman said, "There is no comparison.... The Z100 could run rings around the H11.... The H11 is Sixties technology."

In a similar vein, someone asked, "What is the future of the H8?" Watzman answered, "It's a discontinued product. We're selling off what inventory we have. But we are supporting it from the parts and software points of view."

(For further information on the history and future of the H8, see "The H8's Fifth Anniversary: Origins and Outlooks" in the Fall 1982 issue of *Sextant*.)

The Q & A session closed with a few questions about the hardware and software of the Z100.

"No, HDOS will not exist for multiuser environments."

"Yes, there's enough documentation so that a fairly knowledgeable person could implement a light pen, but I can't say yet whether it will be available as a product."

"Perhaps the keyboard *should* have been detachable.... That would have been an entirely different product, and I can't talk about a non-announced product."

That last demonstration of fast footwork drew a laugh from the audience. Despite the many demanding questions he was asked, it was clear that the audience welcomed Watzman's information about the Z100 series. His Q & A period was one of the most useful sessions of the entire conference.

On to operating systems: Gregg Chandler et al.

The next speaker was Gregg Chandler, current guru of the Zenith Disk Operating System (ZDOS). He was surprisingly young: his three-piece suit didn't quite mesh with his long blond hair and wire-rimmed spectacles. He gave a technical presentation about some of the more important features of ZDOS.

He listed ten advantages of the Microsoft Disk Operating System (MS-DOS) which is the basis for ZDOS. A few of those advantages were: 1) device-independent input/output (I/O); 2) an advanced disk-error handling feature; 3) some powerful systems programming tools, such as a macro assembler; and 4) compatibility with the IBM Personal

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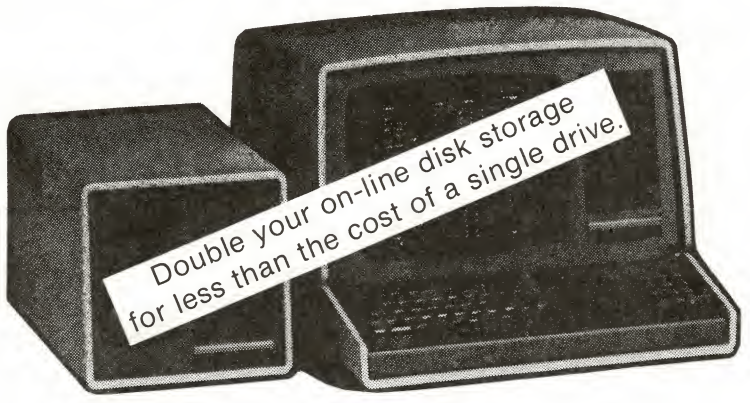

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Photo by Charles Floto

An impressively high percentage of HUGgies showed up for the early morning speeches in the meeting hall.

Computer. Then he discussed some of the specific benefits of the ZDOS implementation. For instance: there are several additional, easy-to-use utility programs; it supports a "soft" keyboard — with programmable function keys; and it has been fully tested.

Two other young software engineers also took the podium. Dave Perkins spoke more about MS-DOS and Bill Zurney spoke about the new implementation of CP/M-85. Addressing the question, "What did we do in the BIOS to enhance CP/M?" Zurney said, "The BIOS is split into an 8-bit version, which is just a stub, and the entire rest of the BIOS, which is written in 16-bit code .... Character I/O is table driven, which enables us to support a wide range of printers with one driver...."

Al Dallas, contributing editor of *Buss: The Independent Newsletter of Heath Co. Computers*, explained some of the advantages of CP/M-85 in the August 24, 1982 issue: "The trick here is that they use the built-in 8088 as a sort of slave processor. The entire BIOS (except for a 1K stub) is above CP/M's 64K memory, into the address space used by the 8088. BIOS calls invoke the 16-bit microprocessor. This adds speed and flexibility, and increases the size of the transient program area, functionally increasing the size of user memory...."

Zurney, Perkins, and Chandler were, perhaps because of their relative youth, among the less spell-binding speakers of the day, but they relaxed during the question and answer period and provided some interesting information.

One user asked whether hard-sectored disks would be compatible with the Z100. Chandler replied, "Unfortunately those won't be usable with the Z100. There would be a fundamental problem." Chandler sympathized with the user's predicament, saying that he had quite a few hard-sectored disks himself. Then he added earnestly, "That's a very good point and I'll write it down as something I want to remember."

Barry Watzman came to the stage to field one important question: "What major expensive programs are compatible with the Z100?" He ran down a short list: "SuperCalc, **yes**; Digital Research programs, **yes**; Micropro, **yes**; Microsoft languages which Heath/Zenith sells, **no**, because at Microsoft's insistence they come with protective features which must identify the hardware environment as an H/Z89; Condor, **no**"; Watzman guessed that most 8080 software **would** run.

After the operating systems engineers fielded a few more questions, they closed the meeting, and the conferees repaired to the busy exhibition hall.

Saturday at the exhibition hall

I was in the meeting room listening to speeches almost every minute of the day, so I didn't have much chance to observe the exhibition hall. After the conference, I asked John Walker, our technical editor, who manned the *Buss/Sextant* booth, if he had any especially interesting anecdotes to relate.

He thought carefully for several minutes.

"People came, people went," he said, summing it all up in his incisive way.

John sold subscriptions; he fixed subscribers' mailing addresses; and he talked to *Sextant* writers, some of whom stopped by for a visit. He also distributed copies of *Buss* #43, which contains a style guide for prospective *Sextant* authors.

(If you'd like a copy of the style guide, drop a note to John Walker, Technical Editor, *Sextant*, 716 E Street S.E., Washington, DC 20003. Or, if you wish, you are welcome to call him for further information at 202/544-2867.)

The speeches were piped in from the meeting room so that HUGgies could listen as they browsed.

There was a lot to see on Saturday. Heath/Zenith had a big table in the center of the room, where they were showing off the Z100 series computers. Zenith Data Systems set up a table in one corner of the room to recruit engineers. Virtually every major independent support vendor had a table in the crowded exhibition area, and a few who didn't have tables were there handing out literature. Here's a roster: *Buss* and *Sextant*, Magnolia Microsystems, Software Wizardry, Cleveland Codonics, Sunflower Software, Livingston Logic Labs, Hoyle and Hoyle Software, Evryware, Extended Technology Systems, Keyboard Studio, Zeducomp, Micro Peripherals, Inc. (MPI), C. D. R. Systems, Generic Software, Artra, Market Developers, Inc., New Orleans General Data Services, Ultimeth Inc., MI-8, D-G Electronic Developments, Tektronix, and Phillips Engineering. They were all at the HUG Conference with products for Heath/Zenith computer users.

(Henry Fale of *H-Scoop* — formerly *H8Scoop* — and Quikdata Computer Services didn't have a table, but I did catch sight of him in the exhibition

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CP/M compatible	yes	yes	yes	yes	no
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Supports all H89/Z89 hardware	yes	yes	yes	no	no
8 bit clock	2MHz	4MHz	2/4MHz	5MHz	none
16 bit clock	none	none	8MHz	5MHz	4.7MHz
Maximum memory	64k	256k	1048k	756k	756k
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area, roaming around in a three-piece suit with a walkie-talkie on his hip. [I am advised that what I saw should properly be described as a two-meter transceiver. It sure looked like a walkie-talkie to me.] I entertained myself for several minutes by trying to figure out for what purpose he was using the walkie-talkie. I came up with some colorful hypotheses, but I never did get a chance to find the *real* reason.)

Saturday evening

Don Moffet, president of Zenith Data Systems, began his keynote speech by asking, "Is there *anyone* out there who doesn't have a Heath/Zenith computer?" Only two people raised their hands.

(There must have been *some* error in this survey, since at least one member of the audience, myself, was too cowardly to admit that I, in my capacity as starving young staff writer, cannot afford a computer right now. I *do* use an H8 every day at work.)

"This is the most loyal body of Heath users in the country," Moffet declared. "You represent a body both demanding and critical. As the guy in charge, I applaud your criticality. It's helpful to the decision process to know what your customers want." (It also helps Moffet ensure that Zenith Data Systems remains a profit-making enterprise.)

Moffet was clearly proud of the work Zenith Data Systems has done over the past two years. ZDS "is responsible for development of all computer products, kit-form and assembled," and "for determining the future direction of the Heath/Zenith microcomputer and terminal business."

Moffet said that the number of software products with the ZDS label "went from one product in January 1981 to 21 at the present time." On the hardware front, "we went from 1980 with one 100K inboard disk drive to a posture with from 200K to 1.2 to 10 megabytes capability." ZDS has also shipped 100,000 ZVM121 monochrome video monitors, making the ZVM121 "the leading industry product" and giving ZDS "a majority market share."

Moffet told us the results of an examination of Heath/Zenith's position in the microcomputer industry. Creative Strategies, a consulting company, took a survey in July 1982 which ranked Tandy number one, Apple number two, and Heath/Zenith number three in the small business computer market. Moffet also provided the results of a similar survey by Dataquest, which gave the top four in this order: Tandy, IBM, Apple, Heath/Zenith.

Now, "having postured ourselves as a solid number three or number four, what are we doing to increase the strength and posturing of our company?" Moffet asked.

(For a moment, an improbable image flashed

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before my eyes: Don Moffet walking around with a *very heavy* book on his head, working on his "strength and posturing.")

"You won't see us on Monday Night Football," Moffet said. "TV ads are not cost-effective for us." Zenith's major advertising is in the print media, "in every alternate issue of *Business Week* and *Inc.* magazines." Zenith Radio Corporation, of course, advertises its audio/video products all over the place, including big-ticket magazines such as *National Geographic* and *Life*. Moffet announced that ZRC had begun adding a footnote to those ads, mentioning the fact that Zenith Data Systems sells microcomputers. Zenith has also "entered into the sponsorship of 'Minding Your Business', a two and a half minute radio show with a 30-second blurb for ZDS at the end. The show is narrated by the editor of *Inc.*, and is carried by more than one hundred radio stations across the country.

(I would like to insert a personal comment about ZDS advertising. Everyone in the United States has heard of Zenith TVs. People are not yet similarly aware of Zenith Data Systems' computing products. *I* would like to see Zenith Radio Corporation divert some of its advertising budget to promoting the Zenith computer community. I wouldn't even mind seeing the Z100 on Monday Night Football, right after Howard Cosell.)

Moffet concluded his speech by returning to "the flagship product, the Z100." He said, "Of all our endeavors, this has involved an unusually high measure of work of the team at ZDS. We're proud of our achievements, and we hope you'll be just as proud."

HUG honors five

The door prize ceremony was exciting and entertaining, especially since the possibility of winning a Z100 machine had stimulated everyone to bouts of wishful thinking.

(But *no one* was thinking more wishfully than I was. The names for the prizes were drawn from the list of all HUGgies who had signed in at the registration booth. I wasn't even on that list. I was pre-registered, but when I arrived, HUG wasn't ready to open the booth. And by the time they were, I was too busy interviewing exhibitors to wait in the registration line. So the chance that I would win the Z100 was absolutely zero — and I didn't know it.)

The proceedings began with Jim Blake as master of ceremonies. He teased Don Moffet of ZDS and Joe Schulte of Veritechnology by presenting them with the astronomical bills for Saturday's catered dinner and lunch, respectively.

Bob Ellerton then presented five special plaques "for outstanding support of the Heath/Zenith user community." One went to William "Doc" Campbell, a prolific — and perhaps prolix — contributor to *REMark*, the publication of the

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Rubik's Cube: A Computer Simulation in Microsoft BASIC, by Arthur A. Frost.

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A Parallel Interface for the '89, by J.C. Hassall.

What's A Company Like Zenith Doing in the Computer Business?, by Jerry K. Pearlman.

Summer 1982

Heath/Zenith Independent Support Highlights the 7th West Coast Computer Faire, by John Walker.

What to Do with Your H88/89 After the Movers Have Finished Playing Soccer and Dropsy with It, by David Esche.

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New Zenith Computer Line Offers Something for Everyone, by Charles Floto . . . a look at the Z100 series which includes full color pictures of the interiors *and* exteriors.

Fall 1982

The H8's Fifth Anniversary: Origins and Outlooks, by Frederick Zimmerman.

Putting the "O" in OEM": Magnolia Microsystems, by Hal Glatzer . . . how this family business has expanded.

Experiment with Artificial Intelligence on your Heath/Zenith Computer, by John Mays . . . a review of John Krutch's book on how to use your Heath/Zenith microcomputer to explore artificial intelligence.

The World's Fastest Sort?, by Rick Lutowski . . . mathematics are the answer, not new equipment.

How to Save Kilobucks with a Business Microcomputer, by Don Carter . . . the H/Z89.

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Heath Users' Group. The next went to Bill Parrott, who developed much of D-G's software. He was the first to suggest a national HUG conference. As Parrott walked to the stage, the audience gave him the biggest hand of the evening. Henry Fale, editor of *H-Scoop*, was honored next. Charlie Floto, editor and publisher of *Buss* and *Sextant*, was given a plaque, too; I'll describe his presentation in a moment. Finally, Mike Cogswell, also known as Mr. UDUMP, was honored — with a check for over nine hundred dollars — as the first participant in HUG's "Jingles in Your Jeans" software distribution scheme, which pays royalties to authors of HUG software.

(These awards weren't a surprise; they had already been announced in the July issue of *RE-Mark*. I think that announcement stands on its own, so I'll reproduce it here:

> Saturday evening at the dinner, some special awards will be made to the following individuals:
>
> Doc Campbell ... for authoring the longest SUMMARY in the history of journalism, which appears on page 10 of this issue ... and continues next month!
>
> Bill Parrott ... for suggesting that there be a national HUG conference and that it be held in his home.
>
> Henry Fale (*H-Scoop*) ... for telling it like it almost is.
>
> Tom Jorgenson ... for maintaining the longest running dialog on MicroNet without a carriage return ... or modem.
>
> Ray and Nancy Massa ... a four color life-sized poster of the H10 high speed paper punch mass storage device.
>
> Charlie Floto ... for introducing sex to the computer industry.

The column was signed ":JB:" — Jim Blake.

Buss *boss baffles Bob, Blake;* Sextant *steals stage*

Al Dallas of *Buss* claims to write in the style of one of those Rooneys (Andy, or is it Mickey?). Whatever he does, it works. I don't think I can improve on his report of the low comedy which ensued when Charlie received his prize. (After all, some people think of Al as an *expert* on farcical reporting.) So, without further ado, here's an excerpt from Al's fine article on the HUG Conference in the August 24, 1982 issue of *Buss*:

> "What can I say about this next guy? He's my competition. I guess you all know who I mean ... Charlie Floto of *Buss* and *Sextant*," Bob Ellerton said. Everyone else received his award and sat down, but not our quiet, mild-mannered publisher. Charlie walked forthrightly to the microphone to say, "Bob, I want you to know that, contrary

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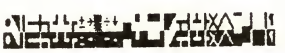
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to your earlier remarks, I don't consider HUG any competition." The crowd loved it.

Later on, HUG gave Charlie a gag gift. Al Dallas again:

> Charlie was brought on stage to receive his gift. As Jim Blake nervously led into the presentation, Charlie (upstage) played to the audience by slowly blowing up a Software Toolworks ("Inflation-Fighting Software") balloon. When Jim finally turned around, Charlie let the balloon exhaust itself, flying all over the stage."

HUG gave Charlie an H10 "high speed paper tape mass storage device." John Walker, our technical editor, promptly appropriated the notorious paper-tape punch/reader for his personal use, saying that he regarded the H10, like himself, as the highest expression of an obsolete technology.

Door prize bonanza

I was impressed by the outstanding generosity of the exhibitors, most of whom donated top-of-the-line products — worth, in some cases, hundreds of dollars — for the door prize drawings. Veritechnology gave away an H25 printer, and the Heath Users' Group contributed an '89. Zenith Data Systems gave away the *piece de resistance*, a Z100 series computer.

Jim Blake opened the drawings by tricking some of the more gullible members of the audience (myself, for example) into believing that he was going to draw the names of the three big winners right away. The drawings *were* made, and the winners *were* selected. The audience hushed expectantly. Then Blake sealed the names into three envelopes taped to a bulletin board behind him — in full view of the audience — and the drawings began in earnest.

I won't try to catalog all the gifts. Suffice it to say that every exhibitor provided a prize, and there were a lot of happy HUGgies at the end of the evening. I'll just hit a few of the high spots. For example, Bob Ellerton gave Ray Massa of The Keyboard Studio a copy of the poster designed by his wife Nancy, and gave Nancy a copy of the poster that Ray designed. (HUG had already given everyone at the conference the H8 and H89 posters, free. Mine now decorate my living room and my bedroom, respectively, just to make sure that every visitor gets a little dose of Heath/Zenith advertising.) Janet Hoyle, of Hoyle and Hoyle Software, gave away copies of three adventure-style games: A Remarkable Experience, A Galactic Experience, and A Physical Experience (whatever *that* means, as Jim Blake put it).

The prizes got more and more valuable as the evening progressed. H. P. Jones of Stillbanks, Illinois, received a subscription to *Buss*. Len Bateman of Downers Grove, Illinois, received 12 issues of *Sextant*. Bob and Pat Kres of Kres Engineering gave a copy of PASCAL MT+ to Donna Brete of Oberlin Park, Kansas. This was the only gift which caused the audience to sigh with envy.

Reuel Launey of Artra gave his Housemaster home control system to Milton Grasshoff of Milwaukee, Wisconsin. D-G gave a Super-89 board to Tim Miller of Bolingbroke, Illinois. Cleveland Codonics gave a copy of their Imaginator graphics board to a HUGgie from Hudson, North Carolina. Magnolia Microsystems gave Kelly Young of New Jersey a double-density disk controller. Tom Jorgenson of Software Wizardry is very active on MicroNet; Bob Ellerton gave him a do-it-yourself serial modem kit consisting of two tin cans and some string.

The room became quiet and still as the names were read for the three major prizes.

The first name was Gary Malcim of Wheaton, Illinois, who received an H89.

The second name was that of a man from Illinois who was "at a party," and missed out on an H25 printer.

The next name was that of another man from Illinois who was also "at a party," and also missed getting an H25.

A Mr. Nelson of Milwaukee, Wisconsin, didn't go to the party, but he *did* get an H25.

Mr. (& Mrs.) Michael Caddy of Doylestown, Pennsylvania won the Z100. Mr. Caddy didn't think that he could afford to go to the conference, but Mrs. Caddy encouraged him to go anyway. When Caddy's name was announced, his wife let out a scream of joy — and understandably so!

Sunday morning

The Sunday agenda began at 10:00 with a meeting for local Heath Users' Groups.

Jim Blake, again acting as master of ceremonies, told the audience that yesterday there had been one major cause of complaint: the infernal racket made by hundreds of digital wristwatches beeping to announce the hour, almost — but not quite — in sync with each other.

Blake introduced the first speaker, Bill Johnson, founder and former president of the Capital Heath Users' Group (CHUG), which Blake called "the best organized and best disciplined club." Johnson gave an impressive account of CHUG's past and present activities. I think many HUGgies came away with the impression that CHUG is a colossus in the realm of micro users' groups.

(Watch for the Spring 1983 issue of *Sextant* for a report on the CHUG regional conference held in November.)

CHUG started out in September 1978 with 22 people. It now has 536 members, 85% of whom are residents of the Washington metropolitan area. "The first big problem is how to contact potential

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members," said Johnson. "Usually a Heathkit Electronic Center or an electronics parts center exists where you can leave flyers, etc." The Heath/Zenith community has a number of publications which can be helpful in getting a local club started: *REMark*, *H-Scoop*, *Buss*, and *Sextant*. "*Buss* did a phenomenal amount to help us get going," Johnson said. "Charlie Floto provided us with a list of phone numbers.... We sent out 16 invitations and 22 people showed up.... Now we're picking up 20-25 members per month."

What can a local HUG do to support its members? "When people join the group there's always going to be somebody who thinks that his Heath/Zenith computer entitles him to unlimited consultation and on-site maintenance," Johnson observed. In fact, "You don't owe them much at all." However, "You do need to have somebody who can be a sounding board for new members, whom the new member knows he can contact."

Johnson went on to talk about some of the services CHUG does provide. For example, CHUG has a "fantastic" software library, with more than 140 diskettes. The club librarian sells them for a small profit at $4 each, and Johnson said that CHUG does more than $1,000 per month in sales. He offered some tips on how to run a software library. "**Don't** mess with proprietary software.... People may even try to donate proprietary software to your library! ... Avoid it at all costs."

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And "**do** charge a small but reasonable amount for your diskettes." CHUG uses the profits from its software library to support other operating costs. During the Q & A session which followed, several clubs expressed an interest in buying disks from CHUG's software library, and the audience in general seemed quite impressed by the unmatched size and quality of CHUG's library.

Another service CHUG offers to members is a well organized group purchase plan. CHUG has a lot of combined purchasing power. "We purchased an order of a popular $700 relational data base for $350 each." Johnson warned: "in handling group sales, try to distribute the workload as much as possible. It's very easy to rely on 'experts', and burnout can be very easy, too." Novices sometimes feel that they can't help the group; but they can help with organizing group purchases, and "they *want* to contribute."

The CHUG newsletter is 20-40 pages long and it is sent to about 600 people. The outstanding quality of the newsletter is made possible partly by the size of the group. But Johnson was emphatic in assuring his audience that even with a small group it *is* possible to have a good newsletter, by cooperating with other clubs. His advice, in one word: "Exchange."

Bill Johnson answers questions

This part of the meeting was originally intended to be used for "raining on HUG," but most HUGgies did not seem very interested in criticizing the national HUG. Some of them preferred to ask questions about CHUG. Others wanted to take this opportunity to inform their fellow conferees about some of the activities of their local HUG.

For example, Keith Becker, program director of the Cincinnati HUG for the last 15 months, had some suggestions on how to arrange for interesting speakers at club meetings. He talked to a local university and set up a demonstration of the university's remote time-sharing system; he got a local electronics store to show some products; and he was even able to persuade the regional representatives of Epson, CompuServe, and Intel to stop off in the Cincinnati area to make presentations. He said that this active schedule had improved the quality of the CINHUG's meetings and he encouraged other HUGs to follow suit. Becker offered one final word of advice, which was endorsed by many speakers later in the session: "Hold club meetings at a consistent time." CHUG, for instance, meets in a high school auditorium, which is closed during school holidays. They consider regular meetings so important that they pay to keep the auditorium open on holidays.

Many HUGgies were also concerned to know whether or not their organization qualified as a nonprofit organization for tax purposes. CHUG happened to have a tax lawyer. He advised them

that the first step is to incorporate; then you can apply "under 501(c)(3) for tax-exempt status" as a charitable or educational organization. CHUG, with its tax lawyer, is now "going for 501(c)(7)," or exemption as a recreational club. No doubt the tax experts at many local HUGs will watch CHUG's progress with considerable interest.

One speaker caused some controversy. "I'm J. C. Love from ANAHUG in Anaheim, California (the state which brought you Howard Jarvis and Proposition 13), and I'd like to propose a thought. I don't want to get anybody angry.... I would like to get some input from the national HUG ... I'd like to put out a pebble for thought, let it roll around in everybody's head.... We don't have an organization dedicated solely to the Zenith public domain software. I would like to see HUG be a nonprofit group and let the independent software vendors handle the expensive programs."

Bob Ellerton, manager of HUG, explained why HUG should still handle expensive programs. Essentially, he said that HUG is a *de facto* nonprofit group already. "*REMark* was borderline sometimes," he began. "In December 1980, we decided to do ten issues in 1981. The HUG staff and myself were working very hard to get software to the membership without increasing the dues. Twelve issues of *REMark* draws off every penny, if not more, of income. We're looking at a four-page increase in *REMark* in the next four months. In January, we're going to add another sixteen pages. We don't want to increase the cost.... Yes, software is expensive. But do we want to pay the extra $3 per disk to get HUG going upward? I feel HUG is not an aftermarket source of income. It is an aftermarket source of support only.... I'm a customer-oriented person."

One *Sextant* author then stood up to offer a plug for his Heathkit Electronic Center. Ken Patrick, of the Dallas-Fort Worth Heath Users' Group, said, "We owe our life to that Dallas store. It gives us considerable discounts on software, so much so that I feel guilty when I buy elsewhere.... The store spent a fortune on folding chairs for meetings ... and purchased a Z89 for a bulletin board.... That's support, people!"

One HUG member from the Great White North raised his hand and interjected, "Can Dallas open another branch in Minneapolis?"

James Donlon of Longwood, Florida, reported an experience almost opposite to Patrick's. In his area of central Florida, "We have no store, and no access to a store.... We have had to pool our resources in order to exist...." The Central Florida Computer Society is composed of a number of small user groups, of which the Heath/Zenith group is just one. "Still, we manage to function effectively." Donlon's approach seems like a good strategy for other HUGs located in out-of-the-way areas.

Bob Ellerton closed the HUG meeting with a flourish. He announced that HUG would begin shipping three free copies of each new HUG software library disk to local HUG club librarians. Since the programs will be under the control of the librarian, HUG won't have to worry about software piracy, and HUG members will be able to get an advance "look-see" at new products.

And when J. Gordon Letwin talks about operating systems, people listen.

Gordon Eubanks of Digital Research

"I've been coming to users' group meetings since 1976, and this is far and away the most impressive group I've seen," said Gordon Eubanks, the man who wrote CBASIC. He is now vice president for languages at Digital Research.

"I'll tell you everything that's even close to what I'm allowed to tell you," Eubanks promised. He told his receptive audience, "I see stuff not only from the U.S. but also from Japan.... I see a lot of computers before they're released ... and the Z100 is a fantastic piece of hardware."

He then proceeded to offer an overview of the microcomputer business as seen from Digital Research. "The industry is growing incredibly fast....

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If there's one thing that's key at Digital Research it's the emphasis on standardization. I'd say that 90% of our effort goes into three areas: getting standard operating systems, standard languages, and most of all, not least of all, standard graphics.... The industry is growing incredibly fast.... It now takes national distribution to sell programs."

He also discussed other changes that are quickly coming up on the industry. "It's hard to believe, I'm sure," he said, "but we need to improve our documentation," referring particularly to user manuals. "That's the trend in the industry. The stuff we shipped in 1977 can't hack it now," Eubanks said. CP/M documentation is notoriously difficult to use — especially when compared with the high quality documentation the Heath Company has traditionally produced for its construction manuals. So it was reassuring to hear a Digital Research official own up to the fact that CP/M documentation could use some improvement — like much documentation that relies excessively on "bureaucratese" and the passive voice. He added a charming personal comment: "Now we're writing in active voice," he said, "and I can't handle that, so I don't write documentation anymore."

Eubanks also made sure his remarks were addressed to the people who were themselves professionals or hobbyists who kept up with the professionals. A lot of them were in the audience, and his remarks covered something of what to expect from Digital Research. Discussing their new operating system, Concurrent CP/M, he said "We brought it out to be a look-alike to CP/M.... It is a true multi-tasking system.... It is file-compatible with CP/M and MP/M.... [It] handles up to 16 drives.... It allows for 254 I/O devices ... it has password protection...."

Moving along, he raised the question "How can we make applications programmers more productive?" He explained some of the ways Digital Research is seeking to provide answers to this question. For example, he mentioned an "Access Manager" program, "with a binary tree index structure." This program, when used with BASIC, PL/I, etc., "provides a small, compact package ... that allows you to get indexed access to data records," using very fast sorting algorithms.

Perhaps the most interesting project, however, was the "Display Manager." Eubanks explained, "It's a lot of work to design a good screen ... designing menus is just incredible...." The Display Manager "works like WordStar," the popular top-dollar word-processing program. In other words, the programmer can use the keyboard and cursor to create a display screen in much the same way as he can now use them, with word-processing software, to create printed output.

Heath/Zenith developments came in for comment, too. "We think this is a crucial design decision, and absolutely right," said Eubanks, referring to the dual-processor configuration of the Z100 series computers. He referred to other dual-processor computers such as the DEC Rainbow, the Dynabyte Monarch, the new CompuPro, and the new Sony machine, and said: "Looking at the industry trend ... the Z100 is in very good company.... The people going with the ability to build both processors are way ahead."

In his remarks, Eubanks made it clear that Digital Research wants to be in close touch with individual software developers. He told his Heath Users' Group audience, "Take this message on independent software vendors back to the users' groups: you are the heart of the industry."

He told those independents, "The biggest opportunity by far in the software market is in 'vertical markets' — who understands a gas station better than a gas station owner?" Eubanks said, referring to software that meets all the needs of a particular industry.

He pointed out that the wide availability of microcomputers has changed the layman's expectations of software performance. "When you set the computer on their desk, they expect it to work! They even expect the manual to make sense. I can't believe it."

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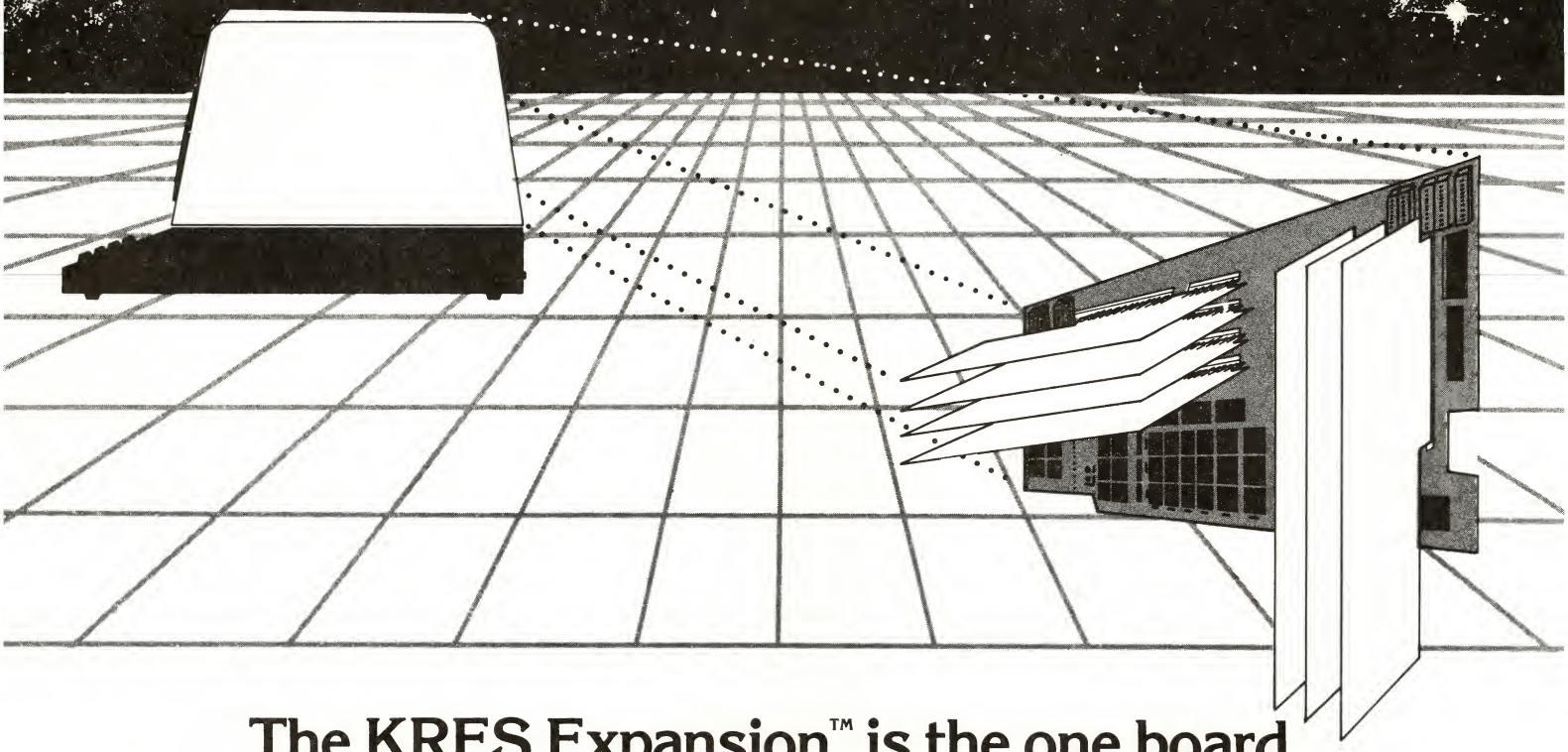

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"We've been putting an incredible amount of staffing into technical support ... we've had 600 to 800% growth in the last eight months." They also hold language workshops, where vendors can talk one-on-one with the people who implemented the languages. They run software vendor conferences, where the information discussed is sufficiently interesting that some hardware companies send representatives incognito. (Eubanks said it's easy to spot the IBM people: they're wearing three-piece suits and they don't talk to *anybody*.) The seminar and workshop programs, in Eubanks' words, "go a long way to help independent vendors."

Eubanks answered a few questions, and then concluded his remarks on a definitely upbeat note: "Thank you. HUG has done a wonderful job."

J. Gordon Letwin on the future of operating systems

"What? We need software programmers? What's he going to do?" That was how some of Heath's hardware engineers reacted when the company hired him away from Wintek Corporation, according to J. Gordon Letwin. He wrote the H8 front panel monitor firmware and the original Heath Disk Operating System (HDOS). Now he is at Microsoft as technical director for Microsoft's operating system projects. "I program half the time and guide other programmers half the time." He concentrated on showing the HUG audience a technical overview of the state of the art in operating systems. And when J. Gordon Letwin talks about operating systems, people listen.

"Computer operating systems evolve in response to the following forces," he said: "1) increasing hardware capability; 2) decreased hardware costs; and 3) fullfilling user demands." Today, "people want the computer to learn to deal with *them*." Letwin classified the current generation of operating systems, including HDOS and CP/M, as "magic cookie" systems: they do a job well, but require a high level of user skill to modify or adapt to other uses. "Either the program will do what you want it to do, or you have to write it yourself," he said, "or you are SOL — sadly out of luck." Letwin is trying to lead operating systems away from "magic cookies."

(Al Dallas provided a good explanation of Letwin's talk in the August 24, 1982 issue of *Buss*. "He advocates UNIX-like systems where 'filters' and 'tools' can be 'piped' together thanks to supportive 'parent' and 'child' shells which create independent I/O environments such that the output of even a simple disk directory can be redirected to form the input of a filter program." Al commented, "[Letwin] is clearly thinking three or four years ahead of the state of the art....")

"The bad old days of non-portability are pretty much winding up," said Letwin. In the past, in order to keep up with the state of the art, many users have been required to sell their old hardware and buy entirely new hardware. "Unless you make some really poor choices, this will be the last time." In response to the somewhat cynical laughter which greeted this statement, he said, "If you assume that eventually there will be a last time, sometime someone will get up on a podium and say that, and he's going to be right, so give me the benefit of the doubt."

"We want computers to be horsepower devices, rather than magic cookies which do four dozen sets of four things exactly." Letwin used an analogy to explain what he meant by "computer horsepower." Cars have several types of engines: 4-cylinder, 6-cylinder and 8-cylinder. The current situation with regard to non-portability of software is similar to a scenario in which cars with 4-cylinder engines could only go on 4-cylinder roads, cars with 6-cylinder engines could only go on 6-cylinder roads, and so on. When software portability is achieved, the situation in software and hardware will be like the "real world" of cars and roads: "you can go anywhere, and what you pay for is how fast you get there."

Final words from the author of HDOS: "Portability really almost is here, and it's important to keep that in mind."

The last word on terminals

Mike Brenner was the next speaker. He is the

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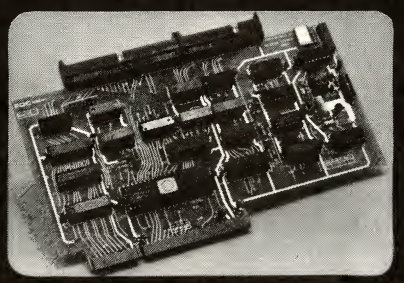

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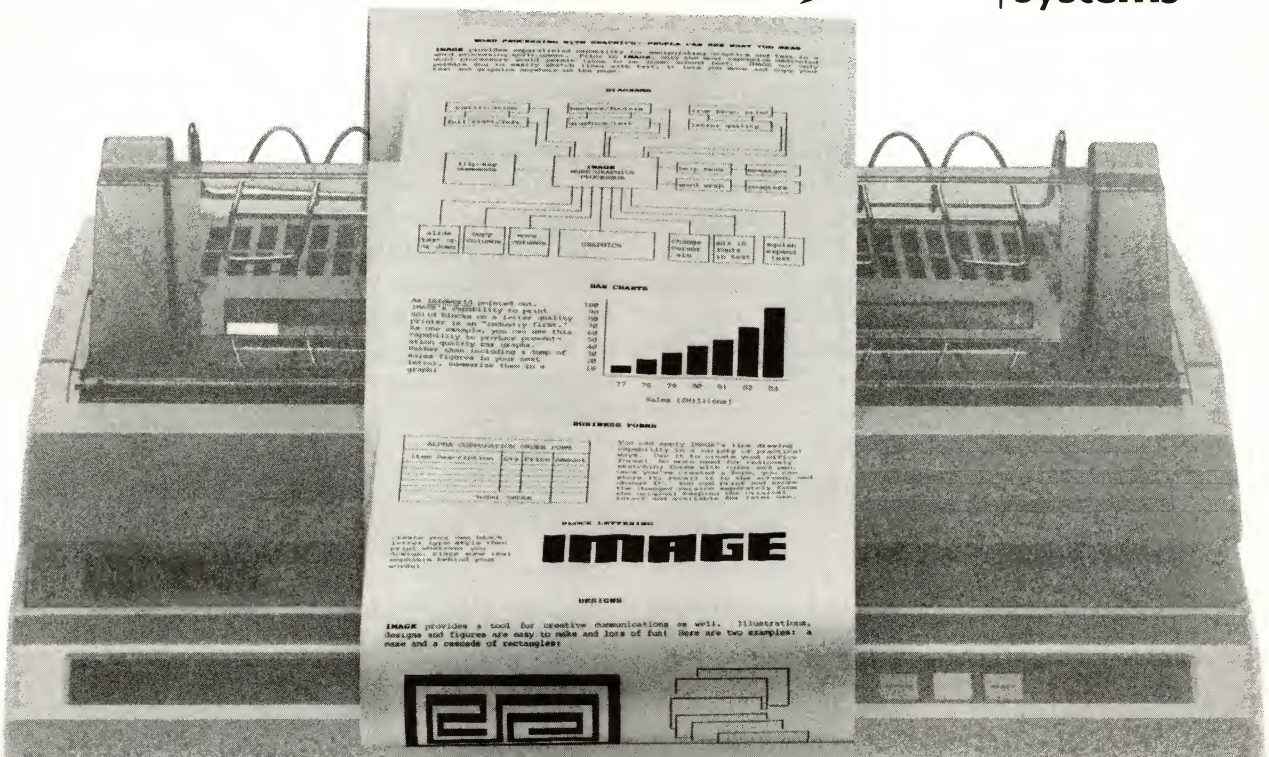

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All quotes are from InfoWorld's *IMAGE* software review, by Marty Petersen, June 14, 1982.

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product line manager responsible for applications software, video monitors, and terminals: "in general, the interface between man and machine," he says. His first step was to explain the precise role of his group in the overall Zenith Data Systems strategy.

He is responsible for deciding the "what, when, and why" of applications software products. In particular, he makes decisions about promotion, discontinuation, and upgrading of products. His group's strategy is to include in its product line applications and tools aimed at the "general purpose" business market. The entertainment and hobby markets are excluded, since they are handled by HUG and the independent vendors.

Next, Brenner turned to a discussion of some of those software products. Multiplan, the new spreadsheet program, "adds a new dimension to worksheet processing.... The user is no longer limited to processing a worksheet that's in memory only. Multiplan allows you to consolidate files on disks.... Multiplan will do all the work.... [It's] a third generation spreadsheet."

Brenner then proceeded to give his audience a thorough explanation of the fundamentals of video monitor technology. "What are the most important parameters to compare monitors?" he asked himself. He answered: "overscan controlling, bandwidth, and video rise time." I'll just give you the two-bit definition (so to speak) of overscan controlling. Basically, overscan is the information which goes past the edges of the screen on a television tube. This is permissible on televisions but not on video monitors. Brenner says that the ZVM134 handles overscan control better than most monitors.

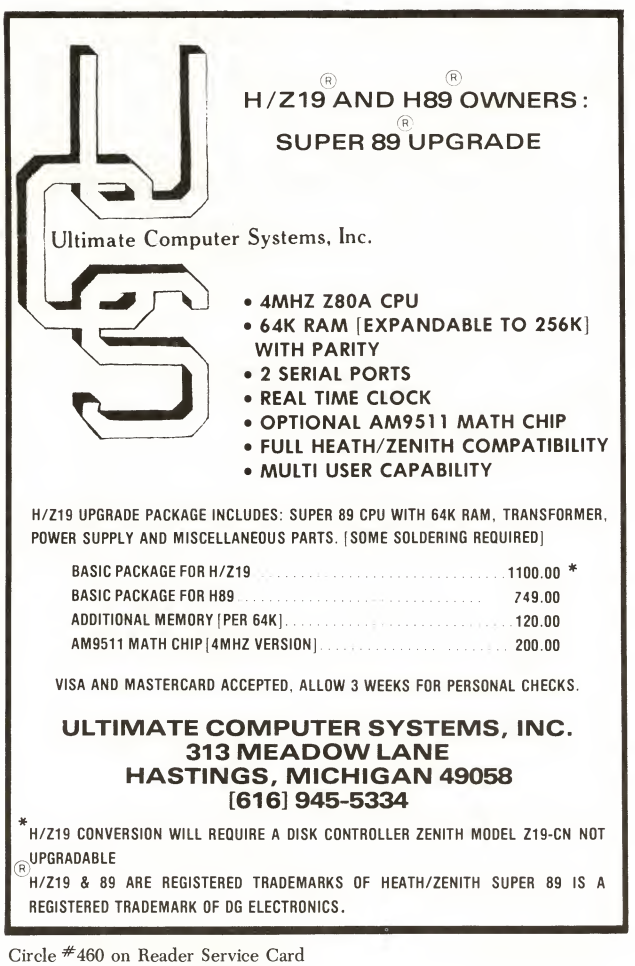
"Video bandwidth, as applied to computer monitors, is [an] almost useless [term]. No two companies publish figures that are based on the same measurements. For example, the ZVM monitor measured by Zenith engineers had a bandwidth of 15 megahertz [MHz]. We took two Japanese monitors that published video bandwidth specs of 18 MHz, and when we compared them, using the same parameters as in measuring the ZVM134, they showed up with 7 MHz or less...."

"The best way to judge one monitor against another in a computer application is video rise time," Brenner said. Video rise time (VRT) is the time it takes from when a signal is received by the monitor to the time when a dot on the tube is lit up appropriately. "[It] is the defining factor on how fast response time is perceived when using computing applications.... A typical video rise time is 20-100 nanoseconds [ns] ... the ZVM134 VRT is approximately 30 ns.... The NEC color monitor has a VRT of about 50 ns." Since a dot on the CRT screen only lasts 140 ns, a VRT of more than 70 ns is clearly inappropriate, and values of 30-50 are in an acceptable range.

Zenith vs. NEC

"Let's look at some video color monitors, both available from Zenith: the ZVM134 and ... the NEC JC1202." The first point Brenner made in comparing the two was that the ZVM134 will take synchronization pulses in either positive or negative polarity, whereas the JC1202 will accept negative synchronization pulses only. "That's fine for the Z100, which produces both negative and positive pulses, but it is difficult to use the JC1202 with the IBM PC because [the PC] puts out positive sync signals...."

The difference between the 20 ns VRT of the ZVM134 and the 50 ns VRT of the NEC is "noticeable," but "they're roughly equivalent," said Brenner. "The video bandwidth on the ZVM134 is 20 MHz, and on the JC1202 it's 8 MHz. The ZVM134 has a 13-inch diagonal screen and the JC1202 has a 12-inch screen.... The most important factor for the two systems, however, is the number of dot triads available on any horizontal line." A dot triad is three adjacent red, green, and blue dots. "The ZVM 134 provides 684 dot triads [per line] while the JC1202 is 690. The difference is a combination of the tube size and the size of the spots that are on the screen. The ZVM134 'pitch' — the distance between any two adjacent dots of the same color — is .43 mm, and the JC1202 is .31 mm. The significance is that the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Software For Heath/Zenith Computers

Text Processor — New Release Version 4.0 — HDOS and CP/M Versions

Text Processor is a screen oriented text editor designed especially for the H19/H89 terminal. The top twenty-four lines of the screen are used as a window into your text file. "What you see is what you get!" Each time you enter any keystroke, its effect is immediately displayed. The twenty-fifth line is used as a "COMMAND MENU". The keypad and function keys control most commands. Text Processor is designed to be easy to use, yet includes a full complement of powerful commands for fast and efficient entering and editing of text or programs. Text automatically wraps to the next line when the margin is reached. Built-in HELP facility and complete documentation are included. This editor even has an OOPS key to undo your mistakes! Control characters and escape sequences can also be inserted into your text for control of your printer features. New features include automatic backup of input file, macro command buffer, command repeat key (repeats up to 32,000 times), back-tab, line number in 25th line, default margin settings, and more.

For HDOS 2.0 or higher (40K memory advised), H19/H89 ..... $59.95
For CP/M 2.x or higher (40K memory advised), H19/H89 ..... $59.95
For CP/M-85 on the Z100 ..... Write for price and availability.

Video Artist Plus — Version 4.0

A unique graphics editor designed for creating graphic displays on the H19 terminal and saving the pictures to disk. Includes these features and commands: READ, WRITE, INVERSE, SCROLL SCREEN, CUT, PASTE, FILL, ERASE, GRAPHICS/REVERSE MODES, CURSOR ON/OFF, GRAPHICS GENERATOR, 8 DIRECTION CURSOR CONTROL, TWO SCREEN PICTURE BUFFER, INSERT LINE, DELETE LINE, DUPLICATE (in 4 directions), INSERT CHARACTER, HELP DISPLAY. Completely "MENU" driven. Uses the function keys and keypad for command entry. Complete documentation is included. Sample programs in both MBASIC And BHBASIC show how to add the pictures to your applications.

For HDOS 2.0 or higher, 32K memory, H19/H89 ..... $39.95

H25/Z25 Graphics Generator

This program contains all of the features of Video Artist Plus for the creation of pictures on the H19 terminal and saving to disk. In addition, graphic displays can be sent from the screen of the H19 to the H25/Z25 printer! Screens can be combined to print 160 column wide by any length pictures. In addition to Video Artist Plus commands, the command set includes: 6/8 LINES PER INCH, 10/13.3 CHARACTERS PER INCH, TOP OF FORM, TWO SCREEN PRINT BUFFERS. A program in BASIC is included for printing continuous pictures from disk to the H25. Use this program to design your own INVOICES, STATEMENTS, LETTERHEADS, OR JUST FOR FUN GRAPHICS.

For HDOS 2.0 or higher, 32K memory, H19/H89, H/Z25 ..... $44.95

Touch Typist — HDOS and CP/M Versions

Touch Typist was written for the Heath/Zenith computer users who use the old hunt-and-peck method of typing. And, for those who already know how to touch-type, Touch Typist has practice lessons to help improve your speed and accuracy. Touch Typist consists of a series of lessons which you can practice at your own pace. This program combines time tested techniques of teaching typing with the instant feedback only possible with a personal computer. See the Software Review in the January 1982 issue of Kilobaud/MICROCOMPUTING magazine for a complete review of this computer-aided instruction program.

For HDOS 1.6 or higher, 24K memory minimum, H19/H89 ..... $29.95
For CP/M 2.x or higher, 24K memory minimum, H19/H89 ..... $29.95
For CP/M-85 on the Z100 ..... Write for price and availability.

Tour-700 — Game Program

Are you tired of the fast action games that seem impossible to win without at least 8 hands? This is the game for you. Based on an old card game played in Europe, this game will entertain and amuse you without tiring you out. A good mix of skill and luck-of-the-cards, TOUR-700 will be enjoyed by youngsters and oldsters alike. The graphics features of the H19 are used to present a game board display. The object of the game is to win a cross country race against the computer. You must overcome flat tires, accidents, speed limits, and other hazards as you make your way through each 700 mile leg of the race. The computer will attempt to place hazards in your way and try to beat you to the finish line. But with a little luck and a keen strategy of your own, you can win. The HDOS version includes both BHBASIC and MBASIC source code. The CP/M version is for MBASIC only.

For HDOS 2.0 or higher, H19/H89, MBASIC or BHBASIC $19.95
For CP/M 2.x or higher, H19/H89, MBASIC $19.95

Attention Program Authors

NEWLINE SOFTWARE is searching for original, high quality programs for the H8, H89, and Z100 computers. We are interested in GAMES, GRAPHICS, BUSINESS SOFTWARE, UTILITIES, LANGUAGES, COLOR GRAPHICS or any other software for the businessman or hobby computerist. Programs must be written for ease of use, take advantage of the hardware features, and be fully documented (source code not required). You can earn high royalites for your programs without interferring with your hobby. We will evaluate your programs in strictest confidence. Materials will be returned only if return postage is provided.

Universal Spooler — New Program

"Spooler" is an acronym for Simultaneous Perpheral Output On Line. In other words, a spooler allows you to output files to perpheral device (printer, etc.) while still using the computer to run other programs. UNIVERSAL SPOOLER provides multi-tasking computing by allowing you to print files in the "background" and use your computer at the same time to edit, run BASIC programs, or any other programs, in the "foreground". Most spoolers require you to purchase a device driver for a specific printer model or provide one or more device drivers with the spooler for a limited class of printers. UNIVERSAL SPOOLER uses whatever printer device driver you currently have on your system. This means that any device driver that takes advantage of the specific hardware features of your printer will work with UNIVERSAL SPOOLER! (Note: Your device driver must conform to the HDOS standards for device drivers.) There is no need to purchase another printer device driver to use UNIVERSAL SPOOLER on your system. Complete source code included.

For HDOS 2.0 or higher ..... any printer $29.95

Resistive Network Design — New Program

"ATTEN.BAS" is a program executed with Microsoft™ Basic which will enable the experienced engineer, technician or hobbyist to quickly and efficiently design a resistive network to attenuate and/or match impedance between systems. H-19/H-89 graphics are heavily utilized to request program inputs as the design progresses. The program is intended to match resistive systems, and will not work with complex impedances.

There are four kinds of resistive networks that are used by the program to achieve the match, namely "Pi", "Tee", "O", and 'H". In a "floating" system the user may wish to use only the "O" and "H", while in a system with one side grounded, the user may wish to use only the "Pi" and "Tee". The user may indicate whether the desired attenuation will be entered in terms of a ratio or in terms of decibels. After receiving the desired value of attenuation, the program will execute for approximately 10 seconds, and will display the nearest 5% values of resistances to achieve the network. The actual values of attenuation are calculated with the user given input and output impedances, and the program-derived 5% standard resistor values.

For HDOS 2.0 or higher, H19/H89, MBASIC $24.95

MX-80* Device Driver (MX.DVD) — New Program

The MX.DVD device driver was designed to make use of many features of the MX-80 and the MX-80 F/T printers. Up to 8 separate units or logical printers are supported by MX.DVD. Each logical printer can be configured to use a different set of MX-80 features, making a single physical printer default to using different features on each logical unit. Each unit of the MX.DVD has a separate table of options that can be set using the HDOS SET program. MX.DVD Device Driver Features:

- Echos current settings of SET options (SET MX: HELP)
- 15 available SET options
- 8 logical printer units, each independently SET
- Automaticlaly converts graphic characters (requires GRAFTRAX* option)
- Allows single sheet printing
- Permanently enables double width or double width / compressed printing — when selected
- Allows changing of the unit settings from software
- Allows aborting or pausing during a printing job
- Selectable printer or software processing of TAB characters
- Automatic page numbering available
- Setting of form length internally and at the printer
- Selectable 8250 ACE modem status register bit interpretation for printer busy signal
- Selectable line height from 1 to 85 dots
- Selectable character size — 40, 66, 80 or 132 characters / line
- Emphasized and double strike printing selectable

For HDOS 2.0 or higher, MX-80 or MX-80F/T $29.95

MD: — Modem Communications Device Driver — New Program

This device driver allows a H8 with a H-8-4 serial interface or a H89 with a H-88-3 serial interface to be used as a terminal for communication with a remote computer system. The switching between HDOS and REMOTE mode is accomplished at any time by the user simply typing a special character on the keyboard. Included is the ability to copy ASCII or Binary files to or from the remote computer system by using the standard HDOS COPY command. Text files received from a remote system can also be directed to the local printer. This driver also can be used as the basis for a bulletin board system. MD supports XMODEM protocol for binary file transfers. 25 setable options.

For HDOS 1.6 or higher, H-8-4 or H-88-3 serial interface and modem communications device . . $34.95

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.31mm screen of dots on the face of the tube is much more difficult, and hence much more expensive. So what you pay for those six dots is at least a hundred dollars ... most of the differential being due to the pitch of the tube and to Zenith's capability for manufacturing all of the components, as opposed to importing them from Japan." Brenner promised that the ZVM134 would be available in October.

Having given the audience his best pitch for the ZVM134, Brenner changed topics. He reported that the sturdy H/Z19 terminals "continue to be headliners." He told us that July was a "banner month" for ZDS, which sold 1800 '19s in all. The usual 20% were H19 kits and the rest were assembled Z19s. Finally, referring to independent hardware and software vendors, Brenner noted: "third party support continues to be strong."

Doug Bonham and educational products

Doug Bonham was the very last speaker of the conference — and his audience was growing rather restless after 16 nearly continuous hours of speeches over a two-day period. On the basis of some unfounded rumors, I personally was hoping that Heath would close the conference with a bang, by introducing a new robot kit (perhaps to be known as HERO, from *HE*ath *RO*bot?), but no such luck. Bonham just told us about the educational product line. He didn't seem very excited about giving the last speech, which may explain why he kept it short and simple. One intriguing possibility did emerge from Bonham's remarks. He seemed very interested in using the Z100's high processing speed and powerful color graphics to create "simulations" of important historical events, such as the battle of Gettysburg. "Simulations are the big new thing" in computer-assisted instruction, Bonham said. If he's right, there could be some interesting "simulation" programs in store for Z100 users.

Finale

"Any last minute questions?" Bob Ellerton asked.

"Where's HDOS 3.0?" someone called out, to the accompaniment of general laughter.

"You guys are phenomenal," Ellerton said. "I'll tell you something, we got Don Moffet's attention last night. He and Bill Johnson were impressed with Heath users."

Indeed, Heath/Zenith leaders were sufficiently impressed that plans for a second National Heath Users' Group Conference are already in the works.

I was impressed, too. The consensus at the Hyatt Regency O'Hare seemed to be that the first National Heath Users' Group Conference was a considerable success. Here at *Sextant*, we're hoping to see an even more "phenomenal" HUG conference next year.

SOFTWARE for HDOS

SUPER SYSMOD2 — This HDOS enhancement program is an expanded version of SYSMOD2 described below. It adds many new features and commands to HDOS which include all the SYSMOD2 capabilities plus the following: alphabetic directory, retaining the original creation date when a file is copied, a DATE switch which selects files created with today's date, a command that copies files that contain hard read errors, SCROLL mode enable, customized system prompt, a free disk space command, a command that searches the disks for a run file, abbreviated commands support 8 unit numbers and 3 drive types (SY:, DK:, DY:) and - best of all - a File Manager command. The powerful File Manager presents the files one at a time on the terminal and gives you a choice of 12 options to perform on the file. For example, just typing DEL will delete it, CO SY2: will copy it to SY2: with the same name, etc. Even the flags can be changed (including the "L" flag). The File Manager is extremely useful for cleaning up a disk full of old files, when backing up a disk or whenever doing a lot of housekeeping..... $29.95

NEW — Softshop drivers are now available with built-in spooling. Get all of the features of UD.DVD, MX.DVD or H25.DVD with a powerful spooler that has a built-in file queue manager which lets you add, delete, restart or abort files, produce multiple copies, pause in a file or stop spooling..... (Each version) $39.95

UD.DVD. — A truly universal device driver for printers. It will operate with virtually any printer through its settable handshake and format options. Using unit members (something like SYO: and SY1: for disk drives), one driver allows you to configure your printer to look like eight printers, each set for different format options. For example, with an H-14 printer, LPO: can be set for 10 CPI with left and right margins, etc. You can even have several printers operating at different baud rates and ports with just one driver. Seventeen options are settable for each of the unit numbers (136 total) and the HELP command will list the setting of each. Requires an H/Z-89 or H-8 with an 8250 UART (H8-4) $29.95

H25.DVD. — A driver designed for the H/Z-25 printer which make extensive use of its features. Has the unit number and HELP capabilities of UD.DVD. In addition, control characters can be inserted in text files to produce subscripts, superscripts and double width, underlined and overprinted characters..... $29.95

MX.DVD — A driver designed for the MX-80 family printers that offers settable unit numbers and a status help display similar to that UD.DVD. Some of the features include use of control characters to implement the more useful escape sequences, selection of desired handshaking mode and polarity, and a transparency mode for full graphics operation $29.95

BASEDIT — A program that modifies HEATH BASIC to provide a line editing capability within BASIC. Allows you to edit a line rather than retyping to correct errors $15.00

HFORTH-79 — figFORTH Ver 1.1 modified to include the full FORTH-79 standard plus many other features. HFORTH-79 operates under HDOS and makes full use of the HDOS file structure including named files for both program and data I/O. Additional features include a full screen editor with over 20 commands, and 8080 assembler, Requires an H/Z-89 or an H-8 with and H-19 terminal..... $34.95

HFORTH — figFORTH Ver. 1.1 modified to run under the HDOS file structure allowing named files for program and data I/O..... $29.95

DISAS — A fast disassembler program that generates source code suitalbe as input to the HEATH assembler..... $25.00

SPANISH, FRENCH, GERMAN and ITALIAN HANGMAN — Programs to help build a basic vocabulary in foreign language.... $29.95

EDGE — A character oriented text editor based on the public domain editor described in REMARK No. 6. Over one dozen new commands $25.00

Unless notes otherwise, the above programs will work with the H/Z-89 or the H-8 with 24K RAM minimum. They are available on 5 inch hard-sectored disks at most HEATHKIT stores or directly from SoftShop. Mail orders are sent postpaid in the U.S., First Class Mail. Overseas orders add $3.00. Payment must be in the U.S. funds only.

HDOS, H-8, H-19, Z-19, H-89, and Z-89 are registerd trademarks of HEATH/ZENITH.

Software for HEATH and ZENITH systems

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SoftShop
Jim Teixeira

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IMAGE: A Word and Picture Processor

Hal Glatzer

IMAGE is an almost-great word processor. If you can live with its shortcomings, it may become your favorite. It comes highly recommended: an all-excellent rating by *InfoWorld* (June 14, 1982; pp. 94-96). As I read the review, the promise of being able to mix words and graphics — and of having multi-purpose function keys to do it — was irresistible.

The first time I used IMAGE, though, I had problems. It's gotten easier since then, and this review was written using IMAGE. But as a professional writer, I have run hard into IMAGE's limitations; it works very well for small jobs, but cannot handle the scope of work by which I earn my living.

In the graphics mode, IMAGE is — as promised — a clever blend of text-handling and low-resolution picture-making. For bar charts, histograms, and columns of numbers or words, IMAGE is superb. It is useful for designing forms and templates and for filling them in; the "bar" character (¦) makes vertical lines. But as a *word* processor, IMAGE is limited by a small file size, an inability to merge files, restrictions on print formatting, and a tendency to require too many keystrokes to manipulate text.

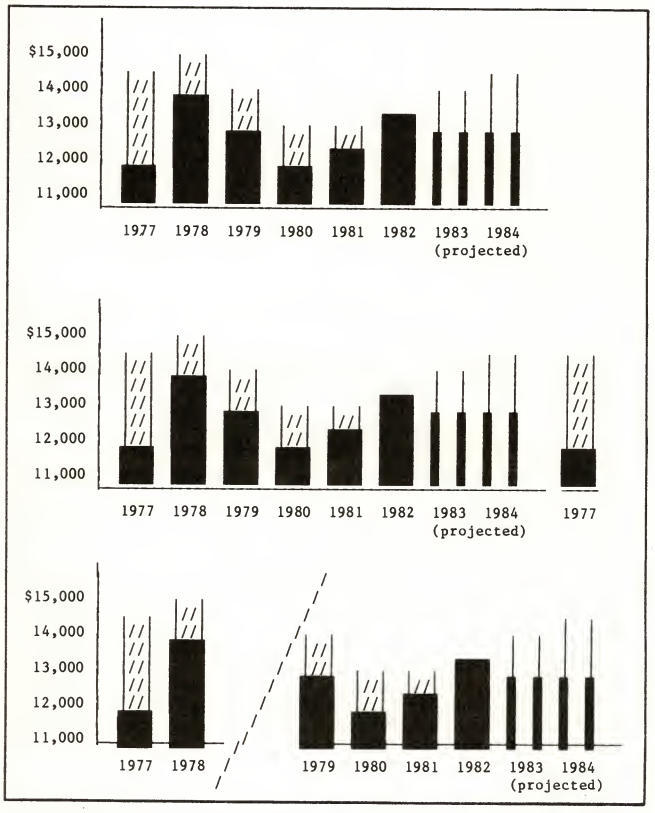
Getting it working

IMAGE comes in a three-ring looseleaf binder, with the diskettes in plastic sleeves. The manual is printed in a 12-pitch italic font from a daisywheel or thimble printer, which is hard to read more than two feet away. But the text itself is clearly written and easy to follow.

I received the IMAGE version that drives Diablo printers, for my Diablo-compatible Vista printer (same as C. Itoh or Starwriter). Because IMAGE comes with a built-in demonstration program, the diskettes had the notation "Demo/Diablo" handwritten on them. In addition to the sealed IMAGE disk, there were three diskettes — labeled FILES, UTILITIES, and BLANK.

Perhaps because I am an end-user and not a computer professional, I was unable to get IMAGE to boot and run without a lot of running around. I had assumed that the sealed disk was the "official" one that I could not open until I had tried and liked the demos. The manual said that the IMAGE disk would boot and automatically begin running. Naturally, I tried booting the FILES and UTILITIES disks, but neither of them "took." I even tried booting the BLANK disk, with predictable results.

My friend at Magnolia Microsystems (who sold me my Z89) said I should "SYSGEN" a blank disk, copy the programs over to it (using PIP) and then



Some of the tricks that IMAGE can perform: a variety of line segments for graphic representation of data; copying whole "columns" of graphics as a unit; moving graphic elements around the page. (Also centering, flush right or left, and full justification.)

boot IMAGE. That got me a bootable disk, but didn't get IMAGE to come up. Finally I called the distributor from whom I'd gotten the package, CDI. I told them my problem, and they initially thought that IMAGE wouldn't run on Magnolia's CP/M. For a while, I was crestfallen! Heartbroken, too, since I was very impressed with the *InfoWorld* review, and — from reading the manual — I had no indication that it would not run under

Magnolia's implementation (ORG 0) of CP/M.

Finally, though, CDI's customer service rep asked me if I'd used the right disk. "The right disk?" I asked, quizzically. "The one in the sealed envelope," she said; "Go ahead and open it."

When that disk failed to boot, I tried copying it onto my previously SYSGEN'd disk. That one booted, but — unlike the manual's description — it didn't automatically run the IMAGE program. I used STAT to examine the file names on the disk, and found that the longest one (37 kilobytes) was called AUTO.COM. As an experiment, I hit CTRL-C to get back to CP/M's "A>" (A-prompt) and then typed "AUTO." Sure enough, IMAGE *can* run under Magnolia's CP/M. The Z89 went to the disk, found the file and began to run it. I was ecstatic. The demo ran — as the manual said it would — after I got into the EDIT mode and pressed CTRL-B. It cycled through its demo for about five minutes while I watched, entranced.

The promise of being able to mix words and graphics — and of having multi-purpose function keys to do it — was irresistible.

THE SOFTWARE SUBSCRIPTION

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DO YOU HAVE ONE OF THOSE BASIC CROSS REFERENCERS THAT SEEM TO TAKE DAYS TO CROSS REFERENCE A PROGRAM? XREFBAS is what you need. Now you can have a BASIC CROSS REFERENCE program that will process a 32k ASCII source in 3 to 5 minutes. XREFBAS for HDOS contains versions for MBASIC 4.xx, MBASIC 5.xx and Benton Harbor Basic. XREFBAS for CP/M contains both Microsoft versions. XREFBAS programs generate a variable name and line number cross reference list which can be output to the screen, disk or printer. XREFBAS programs read from an ASCII file and display the line number being analyzed and all variable names or line numbers discovered on that line. The variable name and line number cross references may be generated together or the variable name cross reference may be generated separately. And best of all, they are FAST!

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Using the functions

After that, I started using IMAGE myself. The most innovative idea about it is its multi-purpose function keys. Over the nine keys on the top row (f1 through f5, ERASE, and the blue, red and white squares), IMAGE displays corresponding reverse-video blocks that identify the functions. F1 is always FLIP, a way of "flipping" the other eight into three additional groups of functions. So IMAGE gives you 32 different function keys, besides the cursor-control arrows, BACKSPACE, DELETE, IC, DC, IL, and DL on the keypad.

Some of the function keys are downright magical, to someone who has been limited to office-style word processing programs. By MARKing the upper left and bottom right corners of a "column" of text (such as a list of names), you can move the entire column (MOVCOL) anywhere on the screen or around the file. This is not simply a block-move, because the vertical integrity of the column is maintained by the "graphics" nature of IMAGE. If you move a column of text into an existing block of text, it overwrites the text "under" it and stays intact. You can also make a copy of a column and SQUISH it into margins half as wide.

One of the function keys (GRAPHX) takes you into the graphics mode for low-resolution graphics. Many Heath/Zenith users don't know it, but an ESCAPE sequence (ESC-F) places the terminal in a graphics mode (ESC-G returns it to text). IMAGE has routed that change through a function key to make it transparent to the user. The graphics are eminently useful for bar graphs, histograms, and blank forms, although it is not possible to draw curved lines; anything that can use 45- or 90-degree angles, however, will work nicely.

Getting used to it

As a writer, I was interested in IMAGE as a substitute for Magic Wand, which I have been using for two years. Sad to say, it will supplement but cannot replace that excellent program. Magic Wand will still have to handle most of my documents. IMAGE has too many limitations.

The most important one is the size of its file space. IMAGE takes up 37K of my 64K random access memory (RAM); what's left over for files is about enough for 150 lines of text (approximately six double-spaced pages, printed). Anything larger than that has to be split into two or more smaller files. In order to insert lines for typing in new copy, IMAGE also requires that the typist "FREE" some additional disk space every two pages or so. This is not (except in line counts) unique to IMAGE, and is probably not a disadvantage. But the limitation on absolute file size prevents me from using IMAGE for any really long articles or book chapters.

Unfortunately, having to break long files into shorter ones means that they are kept out of each

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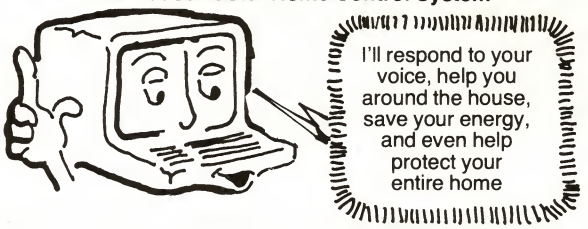
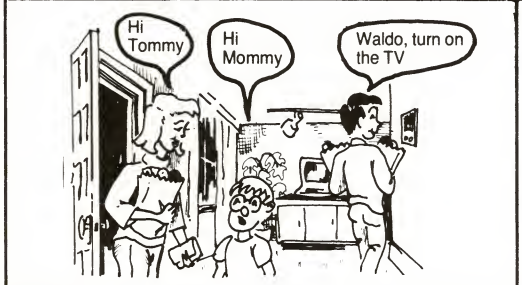
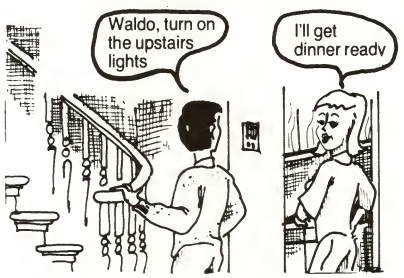
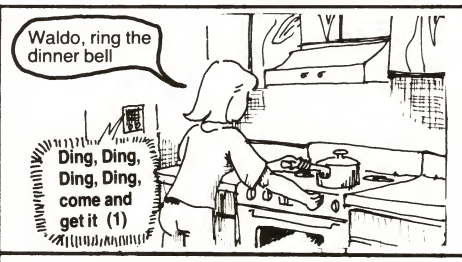


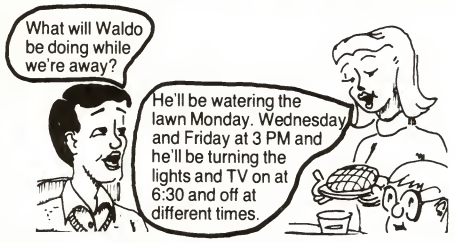
One Day In The Life of Waldo

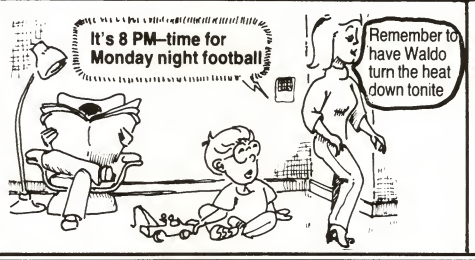


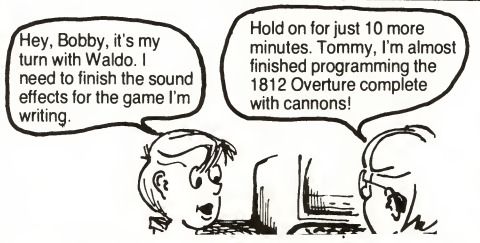




(1) Synthesized computer voice

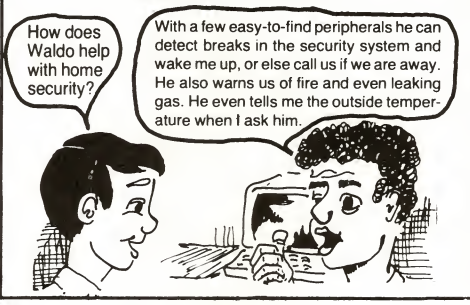

What will Waldo be doing while we're away?
He'll be watering the lawn Monday. Wednesday and Friday at 3 PM and he'll be turning the lights and TV on at 6:30 and off at different times.



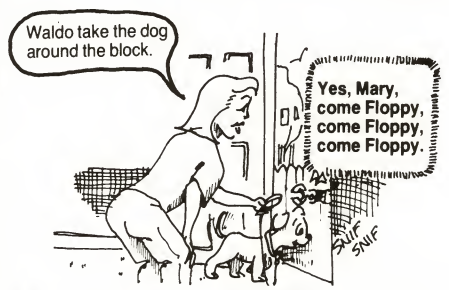

Hey, Bobby, it's my turn with Waldo. I need to finish the sound effects for the game I'm writing.
Hold on for just 10 more minutes. Tommy, I'm almost finished programming the 1812 Overture complete with cannons!

COMING SOON

COMING LATER


How does Waldo help with home security?
With a few easy-to-find peripherals he can detect breaks in the security system and wake me up, or else call us if we are away. He also warns us of fire and even leaking gas. He even tells me the outside temperature when I ask him.

COMING LATER STILL



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.... is the heart of a system that will be expanded with plug-in components and new software which will increase its function and improve its abilities.

*previously sold under the name HOUSEMASTER

Waldo has as standard features:

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.... real-time 24-hour clock/calendar

.... stereo music and vast and varied sound effect capabilities

.... BSR X-10 home control interface

.... a disc with a full library of application programs including the sophisticated versatile control program depicted above.

.... a complete operating manual.

Waldo's Prices

Waldo – *main board with standard features* (specify CP/M™ or HDOS™)

assembled	499.00
kit	399.00

Voice – *robot-type synthesized voice*

assembled only	299.00

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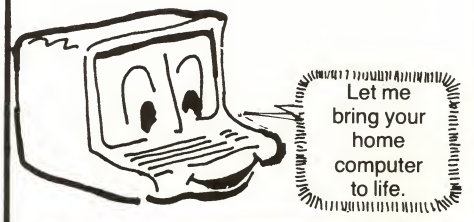
NOTE:

– Waldo is depicted above with some off the shelf peripherals, easily purchased from local suppliers.

– Handicapped people or institutions interested in Waldo will be handled on a priority basis.

Warranty

– 90 day warranty for assembled Waldos and properly assembled Waldo kits



Circle #431 on Reader Service Card

other's reach. That is, I cannot move text between or among files using IMAGE. I would have to do a search-and-replace, for example, on every file in a long document, because I couldn't get IMAGE to look at the whole thing at one time. There is no way to merge mailing lists with form letters or to excerpt paragraphs from one article into another.

Because IMAGE has used escape-sequences and other internal manipulations, the disk files are not ASCII-compatible. So, for example, Spellguard will not proofread IMAGE files. An ASCII translation can be made, which Spellguard will read, but cannot write to! That is, it cannot mark misspelled words in the text.

The most innovative idea about it is its multi-purpose function keys.

Some of the function keys are "tricky." HOME, in the keypad/cursor arrow group, takes the cursor to the top left margin — not of the screen, but of the entire file. To go back to where you were means scrolling through the whole text with the BOTPAG (bottom of page) or ENDWK (end of workspace) keys.

(Switching back to file length, by the way, this is as far as I can go in one file; what follows begins a new one.)

Printing IMAGE files is a simple, menu-driven procedure. (In fact, IMAGE uses menus for nearly everything, but you can't bypass them.) The print functions are limited, though, in some annoying ways: margins, for example. You can set the margins anywhere you like, for screen editing, and they will print that way. But if you set your margins for a page fewer than 80 columns wide, you shorten your available file space (which is counting lines, not bytes). You can't make an 80-column screen display print narrower than that.

Some other print gripes (which, admittedly, are more important to a professional writer than to a person who will be using IMAGE for smaller tasks) include the fact there there is no bi-directional printing, even though my printer can handle it. Also, headers and footers are limited to one line each. They can be alternated flush-left and flush-right, the way book pages are printed, but otherwise they have to be placed all flush-left. No centering and no all flush-right. IMAGE has an unpredictable way of counting lines. The default option (66 lines per page) is for single-spaced printing; for some reason, 33 lines are too many to fit double-spaced (I had to use 25).

And so forth

The day-to-day operation of IMAGE is easy, once you learn the keystrokes. Some activities, however, seem to require a few too many. Inserting new text into a paragraph, for example, takes the SPLIT key to open up space — one line at a time; need more space? keep hitting SPLIT. IC (insert character) is a "mode" that the IC key toggles in and out of; if you insert too many characters with it, though, it pushes the rest out the right margin and into oblivion; that is, the IC mode does not "wrap" text to the next line; and does not keep it in memory someplace out there beyond the margin. There are some useful functions, such as RTWIPE (right-wipe) that erases everything to the right of the cursor, and RTWORD that takes the cursor to the next word in that direction, but there is no way to delete one word at a time.

Deletions leave holes in the paragraphs which

The Author

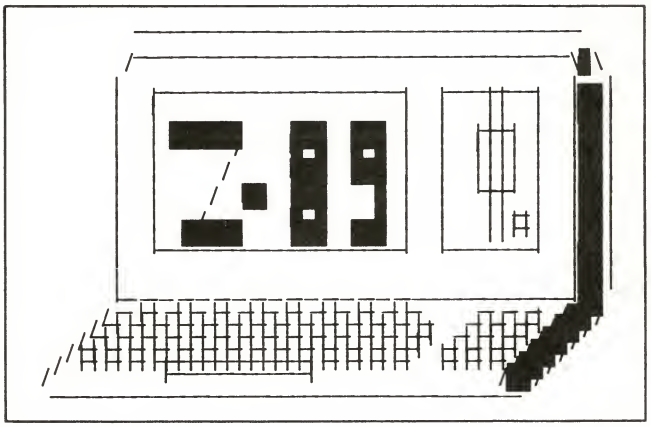
Jim Wolfston, author of IMAGE, is better known in academic circles for writing SCHEDULE25, a program that colleges use to schedule classes. He says it's a mathematically delightful exercise in "N-P complete problems" (the "knapsack" problems). But it's not of much use to small businesses unless they have an IBM minicomputer lying around. (In addition to which, some copies of *Scientific American* might help in order to understand all about "N-P complete problems.")

Why did he decide to produce IMAGE for Heath/Zenith equipment? "When I started writing software for micros, I began with a Zenith computer because I could make reverse-video boxes on the 25th line (i.e., the bottom of the screen) right over the function keys. IMAGE started out as a word processor, but then I discovered that an escape sequence got me into a graphics mode," he says. "That turned the keyboard into a graphics-character generator. Zenith's computers are unique in that way — the graphics characters are provided with the hardware." Through his new software company, MicroArt, he will be adapting IMAGE to other computers, including IBM's PC.

He wrote IMAGE, he says, because "I wanted — as much as possible — to be able to have on the screen exactly what you'd get in print. There are some exceptions, of course, since you can't have true proportional spacing on the screen, but with what I wrote, I could make templates for invoices and things like that."

Wolfston admits that IMAGE has limitations, some of which were not obvious until professional writers commented on them. He will bring out new versions, he says, that close some of IMAGE's loopholes. But first, he has taken over "all rights" to IMAGE from its distributor, and begun to distribute it himself.

have to be repaired. Each time you finish inserting or deleting, you have to tell IMAGE to reformat or "close up" the paragraph (using CLOSEP). When that happens, the screen is rewritten a line at a time and the cursor drops down to the bottom of the paragraph. Thus, if you have to go back to the same place to make another change, you have to get the cursor back there again first.



I drew this with IMAGE in about 20 minutes, and saved it as a file with a name (GRAPH1). The "shadows" are closely-spaced repeats of the vertical bar character on a Prestige Elite daisywheel.

Unfortunately, that print wheel does not reproduce exactly what the screen shows — the corners of boxes, for example, do not make right angles, but crosses. Other print wheels, according to Jim Wolfston, do.

IMAGE, it seems to me, has missed some opportunities. You need to have two disk drives because one holds a "blank" (formatted) disk while the other holds the files. The blank, supposedly, is a "scratch pad" for IMAGE's housekeeping. Why, then, is the RAM space so limited? Some of the disk's 90K (in single-density) could have held the overflow. In the graphics mode, IMAGE displays on screen some characters that its printer-driver cannot put on paper. Why? I wonder.

In the illustrations, you can see a few graphics I made with IMAGE. They show the extent to which a mix of words and pictures enhances both. I asked IMAGE's author, Jim Wolfston, to characterize his program, and he called it "very robust." My own reaction is that it can be that, but until new versions overcome its limitations, I would say it is mainly useful for small jobs where picture-making is as important as text. For any lengthy writing job, IMAGE will be frustrating. I would like very much to see it upgraded.

Ordering Information

IMAGE, $295
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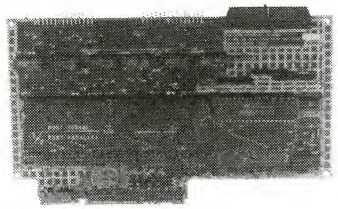

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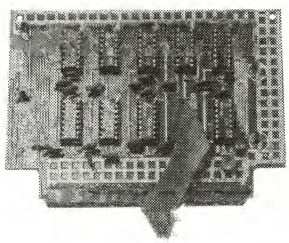

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Eight Spreadsheets Compared: Charting Products to Eliminate Tedious Calculations

Kenneth A. Patrick

The microcomputer has recently been making large inroads into the business and professional world. In 1982, perhaps the greatest value it has provided to the professional has not been the remarkable new language and applications software, but the *electronic spreadsheet*. This last May, when I started receiving software for this evaluation, there were four spreadsheets available to Heath/Zenith users. Since then, four new products in this category were introduced, and a fifth was announced too late to be included in this evaluation. What better indicator of a dynamic, growing software market can there be?

An electronic spreadsheet is basically an editor for producing columnar accounting reports. It remembers how each number is to be calculated. It has lots of storage for columns of numbers and titles, and the ability to perform a different calculation for each position on the report (referred to by nearly all suppliers as a *cell*) based on supplied data in other positions. Now, as any BASIC programmer can tell you, that's no great feat; give him 20 hours and he'll thrust an almost-perfect report in your hands. But make the worksheet interactive, performing calculations before your eyes as you change a critical value, and you've got the makings of a fabulous tool.

Someone recently asked me to expound on all the wonderful things these spreadsheets can do besides tell us we're bankrupt. Unless you're an accountant, you might feel that you have no need for one. In actuality, anyone can use one to solve any number of computing problems.

A local lawn sprinkler system contractor uses one to do estimates on-the-fly. His worksheet has all the parts in his inventory, completely priced. He just enters the quantities required for an individual job and gets an immediate estimate for materials, as well as a parts order list. A builder can use it to estimate the cost of a new house, right in the home of a potential buyer. Options can be added or deleted, and the net price would always be immediately available. A sample program that comes with SuperCalc calculates the size of air conditioning components necessary based on heating and cooling requirements the user enters.

Of course, tax worksheets are a natural, especially with some of these programs that allow data from different sheets to be merged into a single one. An insurance agent could use a spreadsheet program to help him do insurance quotes or help a homeowner do a whole-house inventory. A computer game writer could do a break-even analysis to determine how many copies of a game have to be sold in order to make money. Companies with small inventories could even keep their entire inventory current with a spreadsheet.

Personally, I've used it to do what-if analysis in preparation for opening a retail store—to plan the budget, do sales forecasts, and plan advertising campaigns. I've done job cost analysis and budgeting for my clients in a fraction of the time it would take manually. I recently impressed a banking client with the power of the new micros by duplicating a spreadsheet in two hours that he had paid (two years ago) well over $5,000 to have done by a professional consultant on a large mainframe computer system—and which is still costing him dearly each time it is run.

Anyone required to format and tabulate accounting reports to upper management simply *must* have some form of this software to keep up. Many times an accounting manager spends hours getting a balance sheet to balance, only to have the Boss send it back with a cryptic notation like "*...split out Obsolete Inventory from Regular Inventory and insert a separate line for it.*" Such after-the-fact requests generally elicit great gnashing of teeth (and a call to one's headhunter!). With the advent of the electronic computer, the manager can call upon the great editing power that programmers have had available for years to respond quickly to the Boss's whims.

It's fascinating to build something like an income and expense projection for the year, and start playing "What if..." with it. You can immediately see the effect of doubling the rent, decreasing sales, increasing advertising expenses. Of course, the accuracy of your model will depend on the formulas you've chosen for it.

In short, a worksheet can generally do the job if you need a program that has a large number of numeric variables upon which you perform mathematical functions to obtain still more numbers. You don't write a program, you design an electronic piece of paper upon which your calculations take place at lightning speed and with 100% accuracy, automatically.

The software suppliers were quick to offer this software when they realized its market value. I've been told by more than one Apple dealer that VisiCalc is singly responsible for more business system sales than all the other software packages combined. Until the last year or so, VisiCalc had a corner on the "calc" program market. You were left out in the cold if you didn't have an Apple—if you had, for instance, a system based on the 8080 or Z80 central processor unit (CPU).

But now, with the benefit of the *de facto* standard CP/M operating system (a proprietary product offered by Digital Research), 8080- and Z80-based system users have a number of worksheet programs from which to choose. Most of the packages work fast and well. Each has its own syntax, format, and data storage technique.

Some preliminary comments

Although there are many electronic spreadsheet programs available, I have narrowed this comparative survey to the larger software suppliers' offerings that will run on Heath/Zenith computer

systems. Some of these manufacturers offer distribution formats specifically for the Heath/Zenith system. In any case, the CP/M standard 8" single-side, single-density format is available from all, and one supplies Heath Disk Operating System (HDOS) formats as well.

It would be great if all these packages used the same commands and screen formats, and provided the same services. Then all you'd have to do is shop price and support. Each supplier, however, has a different idea of what a spreadsheet should do, and how it should interact with the user. If we were to combine all the ideas and features, the resulting program would require one of the next-generation expanded-address microcomputers just to load it into memory.

Some improvements, however, require little more than supplier awareness of the hardware they're dealing with. We've all got pet peeves and here's one of mine: only a few software suppliers seem to know that the H/Z19 terminal has anything more than a teletype keyboard. Almost all of these suppliers include a Heath/Zenith configuration menu, but the shifted keypad and function keys are ignored! Once you've made the discovery, you'll get very little help in actually changing your program to use those special keys.

It's one thing to expect a hobbyist hacker to play with hex bytes and a program like DDT.COM. It's quite another to sell to business machine buyers who plunk down several thousand dollars for a "turnkey" hardware and software system—and expect *them* to start hacking. Even the average software dealer will have trouble configuring some of these package to use the keypad. Two notable exceptions are ZenCalc and PerfectCalc, which come configured for the keypad. Another is Multiplan, which describes each of its functions in detail and asks users to press the key(s) they wish to perform that function. The others might do well to look at Microsoft's configuration approach—or at the very least, use the power of the H/Z19 in their Heath/Zenith configurations.

So choosing an electronic spreadsheet package demands a careful evaluation of all the features available in consideration of your requirements. I found it generally took most of a week to get familiar enough with each program and reference material to be able to be reasonably productive with any of the software. Some took longer, others less. I chose, however, to use each supplier's tutorial material (a most important part of the package) straight through, without confusing the issue with another package. This, I hope, allowed me to evaluate each package without prejudicial comparisons and sidetracking. Only when I had tried each package did I do any comparisons.

The programs do have a lot in common. I've included several comparison tables covering the general information about each program reviewed. The descriptive information about each that follows covers what I found particularly remarkable (or disturbing) during the evaluation. I've covered them in the order of receipt of the software from the suppliers.

SuperCalc *by Sorcim*

SuperCalc is a remarkable package, especially for the beginner. SuperCalc is

A Spreadsheet Glossary

What is an electronic spreadsheet/worksheet? (I'll use "spreadsheet", "worksheet" and "calc program" interchangeably in this article.) If you've ever had to use one of those 12- or 16-column financial sheets to organize accounting information, you've already worked with a spreadsheet. All these packages do is automate the entry and calculation functions. Naturally, since most screens are at best 80 characters wide and 24 lines high, it's necessary to provide some way of having a spreadsheet larger than the screen. Most of these programs use the "sliding window" technique, making it appear as if the screen is a window through which you can view a portion of your spreadsheet.

An explanation of some of the terms used with spreadsheets is in order. A "cell" is a single block within the spreadsheet that can contain a single value, be it the result of a calculation or an alphanumeric string. A "row" or "line" refers to a logical horizontal grouping of "cells". A "column" refers to a logical vertical grouping of *cells*. *Cells* are referred to with a name that is a combination of the *row* **and** *column* names. Since each program allows the spreadsheet to be larger than the display terminal, "SCROLL" commands allow you to logically move your viewing area as if it were a window over the sheet. Finally, nearly all of the packages offer the technique of displaying two or more non-contiguous portions of the spreadsheet, a technique referred to as a "split".

Each significant cell has some kind of data in it. Numeric data is just that, a number. That numeric data can be a constant, a variable provided by the user, the result of a calculation (*formula*) based on the contents of other cells, or the result of some built-in function provided by the software package. A "formula" is a stylized statement indicating calculations to be performed in order to arrive at a final value for a given cell. A "function" is generally referred to as a pre-defined calculation or shorthand notation of a formula (an example would be SQRT for square-root). Alphanumeric data, often referred to as a "literal", cannot have calculations performed upon it, though alphanumeric data can be the result of some special functions like a table-lookup.

Each package offers the ability to WRITE or SAVE the entire spreadsheet, and to READ or LOAD one saved in an earlier session. The format of this data file is sometimes unreadable by other languages, and just as often, the spreadsheet program cannot accept files from other common programming languages. Naturally, all the packages also provide for PRINTing the final spreadsheet, either as a whole, or in sections.

Each program reviewed has its own format for the screen. Generally, there are column-headings, line-headings, command-input areas, user-prompts, and status lines as overhead, while the remaining area is used for the display of the user's spreadsheet. Most programs have cursor control keys to allow the user to identify the current cell by highlighting it. A right-arrow moves the current cell pointer to the right, the down-arrow moves it down, etc. Attempting to move it off-screen will usually "scroll" the screen one row or column (or more) to allow the next cell to be displayed. The current cell can also usually be set with some form of immediate positioning command that names the current cell by address.

The user often has several commands that simplify the setting-up of a spreadsheet. COPY and REPLICATE commands make duplication of similar cells easy. Most programs include the option of adjusting each cell variable in the copied formula or leaving it constant. If you want to enter a new formula, some programs provide a "current cell key" to have the program help you fill in the cell address from the work area into your formula, thus keeping you from counting rows and columns all the time. A few packages have an EDIT command which makes a cell's formula available on the command line for editing. Modifications to existing sheets is easy due to intelligent MOVE, INSERT, and DELETE commands which allow the same adjustment facilities available with other replication commands.

Numerous format options may be applied to the whole sheet, columns or rows, or specific cells through comprehensive FORMAT or DECIMAL commands. Most include a WINDOW and TITLE (or LOCK) command, essentially making two (or more) non-contiguous portions of the spreadsheet visible at once, and (optionally) movable independently. The split(s) may be vertical or horizontal.

	SuperCalc/ PeachCalc	ZenCalc	CalcStar	Multiplan	PlannerCalc	MasterPlanner	Microplan	PerfectCalc
Version Tested	1.05 / 1.0	2.1	1.2	0.8	1.01	2.02	3.03	0.5
Manual Size	8.5 x 11	8.5 x 11	8.5 x 11	8.5 x 11	6 x 9	8.5 x 11	8.5 x 11	8.5 x 11
Pages	120 / 190	56	128	414	198	216	118	64
Tutorial	62 / 98	17	96	238	120	135	100	35
Glossary	Yes	Yes	No	Yes	Yes	Yes	No	No
Index	No / Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Binder	Loose leaf	None	Loose leaf	Loose leaf	Spiral bound	Loose leaf	No	N/A
Summary Card, etc.	No / Yes	No	No	Yes	No	No	No	No
Distribution Format(s)	5(S&H) & 8	5(S&H) & 8	5(H) & 8	8	5(H) & 8	8	8	5(H)
# .COM files (total size)	1 (26K)	1 (32K)	3 (6K)	2 (44K)	2 (24K)	2 (26K)	2 (52K)	3 (46K)
# .OVL files (total size)	1 (22K)	2 (10K)	5 (86K)	2 (72K)	1 (80K)	1 (98K)	7 (102K)	1 (32K)
Help File(s)	Not separate	4K	Not separate	36K	28K	18K	38K	Not separate
# Sample files	4 / 7	8	4	1	6	6	2	9
Minimum Memory Required	48K	48K	Not stated	64K	Not stated	Not stated	64K	56K
Max Vertical Columns (count)	A-BK (63)	a-z,A-Z (52)	A-DW (127)	1-63	1-128	1-1000	1-99	a-z,A-Z (52)
Max Horizontal Rows (count)	1-254	1-255	1-255	1-255	Memory limit	Memory limit	1-255	1-500
Theoretical Max Cells	16,002	13,260	32,385	16,065	?	?	68,500	13,260
Practical limit 64K (note 2)	800	500	449	800	?	?	?	1,000
Data Display Area	77 x 20	77 x 23	77 x 15	77 x 19	65 x 19	65 x 19	54 x 17	77 x 22
Free-space Indication	Memory units	Bytes	Entries	%Free & Bytes	Memory units	Memory units	Memory units	None
Data File Storage Format(s)	Binary/ASCII	ASCII	Binary/ASCII	Note 4	ASCII	ASCII	ASCII	ASCII
Retail Price	$295 / $375	$99.95	$295	$275	$99	$495	$495	N/A

Notes:

Note 1: SuperCalc column—if two values appear (separated by a slash), the first is the value for SuperCalc, the second for PeachCalc.

Note 2: Distribution formats: 5(S) = 5¼" floppy soft-sectored
5(H) = 5¼" floppy hard-sectored
8 = Standard CP/M 8" disk

Note 3: Practical limits given in cells and derived from program display of available storage after benchmark file was loaded.

Note 4: Binary; can accept VisiCalc files; Symbolic Link File Format (SYLK—referred to as SYMLNK in the body of the article).

General Information

available from Heath/Zenith, or you can go to Sorcim directly (but you'll pay more!). The manual appears to be Sorcim's own (reprinted by Heath), with a preface for the Heath implementation. The manual provides an excellent tutorial to introduce the novice to SuperCalc. Non-CP/M users will find some descriptions of CP/M commands and some general information about the operating system, but more than that might be required before one can use the system successfully.

SuperCalc commands are displayed as single-character choices, and sub-commands are presented instantly after the main command has been chosen. Sorcim uses what they refer to as *interpretive prompting* to reduce user keystrokes. Each command has a unique starting character, so once you have typed in "/L", for instance, SuperCalc completes the command with "/*Load*" as an immediate confirmation/reinforcement. With this completion, a new prompt requests the next piece of information required for a Load command, asking for a file name. This convention is followed throughout the SuperCalc program.

SuperCalc as supplied by Heath is pre-configured, incorporating all the features of the H/Z19 terminal and its cursor and special function keys. I loaded up the program and began working through the tutorial immediately.

The program keeps track of the current cell by using reverse video in that cell. If you have a non-Heath terminal using enhanced video in place of reverse video, you'll have a hard time finding the current cell unless you read the status line. I expect that Sorcim's general market version can be configured with another "current cell indicator" such as arrows.

Heath warns that the REPEAT key not be used for scrolling if you are using CP/M version 2.2.02 or lower, but that higher levels of CP/M will make use of

	SuperCalc/ PeachCalc	ZenCalc	CalcStar	Multiplan	Planner-Calc	Master-Planner	Micro-plan	Perfect-Calc
ABSolute	X	X	X	X			X	X
ACOSine	X							
AND (logic)	X			X				X
ASIN	X							
ATANgent	X	X		X				X
Average	X	X	X	X	X	X		X
COSine	X	X		X				X
Count	X		X	X				
Cumulative					X	X	X	
Error test	X			X	X	X		
Exponent	X	X	X	X				X
Grow By					X	X	X	
Grtr than		X			X	X		
If test	X	grtr/lsst		X	X	X		
INTeger	X	X		X			X	X
Index/Lookup	X			X				X
Ln	X	X	X	X	X	X	X	X
Log10	X	X	X	X				X
LSR		X			X	X		
Max/Min	X	X	X	X	X	X		X
NOT	X	X		X				X
Pres Value	X	X		X				X
OR	X	X		X				X
Pi	X			X				
Projection			X					
Regression			X					
SIN	X	X		X				X
Slope			X					
SQRT	X	X	X	X				X
Sum	X	X	X	X	X	X	X	X
TAN	X			X				

Some functions unique to one package may not be listed here.

Functions Available

	SuperCalc/ PeachCalc	ZenCalc	CalcStar	Multiplan	Planner-Calc	Master-Planner	Micro-plan	Perfect-Calc
Global	X	X		X			X	X
by block				X				X
by Row	X	X		X	X	X	X	X
by Column	X	X		X	X	X	X	X
by Cell	X			X				
Width	0-116	0-77	3-63	3-32	2-30	2-30	4-20	0-77
Align	R,L		R,L,C	R,L,C				
Reset/Deflt	X			X				
Graphic **	X	X		X				X
Dollars $	Rounded	Rounded	Truncated	Rounded			Rounded	Rounded
Scientific	X	X	X	X				X
Integer	X	X	X	X	X	X	X	X
Decimals	0-16	0-13	0-10	0-15	0-28	0-28	0-3	0-13
Formula Display	X	X		X			X	X

R = entries flush right in column L = entries flush left
C = entries centered

**indicates graphics feature employing asterisks to produce bar graphs.

Formatting Available

the type-ahead buffer. If you're using one of those higher levels of CP/M, you'll notice that SuperCalc interrupts the painting of the screen if it detects the pressing of a cursor key, which greatly improves overall performance. The REPEAT key is quite useful here. The manual also warns that there is no trapping of *circular references*, in which each of two cells refers to the other, thereby causing the cells' values to change indefinitely.

SuperCalc's *Output* command gets your finished spreadsheet onto your printer (or a disk file for later printing, or to your terminal for review). You can select the entire spreadsheet for printing, or just a portion of it. The documentation points out that the *Disk* output can be read and processed by other programming languages. No provision is made to read in ASCII data from another program into SuperCalc. It *is* possible, however, to *Load* portions of additional SuperCalc spreadsheets into yours to allow merging of data.

SuperCalc's printed formula display is organized just as the final report is. This allows you to print a backup copy of your spreadsheet showing the derivation of each cell.

SuperCalc is fast, and makes for satisfying interaction with the user. I found that I needed several days, however, to memorize the functions each single-stroke command provided, and to be able to choose the one I needed.

The biggest disadvantage to SuperCalc is that it lives in its own little world, with little provision for communication to other applications packages. Oh sure, you can read a disk version of a SuperCalc output report, and operate on it with some other program to put it in shape for your applications package. That sort of thing went out with the IBM 1620 in the mid-sixties. It would be great to provide SuperCalc a file full of raw data from another system, such as other accounting software, to allow it to produce reports and statistical breakdowns. Or to have SuperCalc drive a tax package, for instance. At the very least, a thorough description of the SuperCalc file organizations would be helpful so that software hackers could create data to feed to SuperCalc in its native format.

I suspect SuperCalc currently enjoys the same position with Heath/Zenith that VisiCalc has in the Apple world. Many people are buying Heath computers primarily for SuperCalc capabilities, and they will continue to do so.

PeachCalc *by Peachtree Software*

Peachtree Software has an excellent reputation for providing many fine applications packages for CP/M users. I was anxious to see the offering advertised as *MagiCalc*. Peachtree sent it along with a note that a restructure of their product line would soon mean that MagiCalc would be marketed as PeachCalc, and at this reading you should see ads touting the new name.

The PeachCalc manual is a nice-looking buff loose-leaf three-ring binder, with quality index tabs. The print looks like output from a quality daisy-wheel printer, not typeset. I read the first few pages of the Reference Guide for a summary before attempting to start the tutorial section. All through the reading I had the nagging thought that I had seen this product before. All the commands, syntax, and capabilities looked a lot like SuperCalc.

I couldn't wait for the tutorial. I loaded PeachCalc onto the system and ran it. Though the sign-on page was different, once the spreadsheet page came on, I was right at home, since the PeachCalc package *exactly* duplicated SuperCalc features. Was this by design, by mistake, or by middle-manning? A call to Peachtree's Beverly McDonald answered the question, a little. I asked (innocently, of course) what arrangement Peachtree had with Sorcim, and after a long pause, Ms. McDonald said Peachtree and Sorcim had what she referred to as a "technological exchange." (I wonder if this has anything to do with the rumored new word processing package Sorcim will soon offer. On the other hand, perhaps Peachtree plans integrating the spreadsheet with their other accounting packages.)

The fact is, PeachCalc *is* SuperCalc, or at least one version of it. Peachtree is planning enhancements of their own, so it appears they have obtained rights to the source code, and the two products will probably diverge in features. The Peachtree manual was easier to read due to the larger, less formal format, though they are planning a more professional final product.

PeachCalc includes a complete INSTALL program to customize it to any of about 25 terminals, including the Heath H19/H89. Apparently the H19 is not well understood by Peachtree, since considerable effort is required to properly configure for the keypad. Several Heath-compatible distribution disk formats are available.

ZenCalc *from The Software Toolworks*

If you've had Heath equipment for any length of time at all, you've heard of

Software From

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FAST ACTION GRAPHIC GAMES

Featuring graphics like you've never seen on your Heath/Zenith computer. Experience the fun and excitement of these fantastic machine language games.

Exterminator

You are an EXTERMINATOR, the highest rank in your planet's space force. Your elite position gets you selected for the dangerous job of protecting the earth colony on Yargon from the savage attack of the hammerhead anthropod. Arriving on Yargon, you are armed to the teeth with your trusty raygun by your side, plenty of remote controlled bullets, and a small fleet of star-copters. Your mission is to exterminate these invaders before they evolve into the carnivorous anthropod, the terror of the galaxy. (48K) **$19.50**

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What dangers lie ahead deep in the mysterious Orion cluster? Looking out the front window of your spaceship, you see asteroids, Xylon attack ships, and a variety of other mysterious objects coming at you in 3-D space. Maneuver around the objects, vaporize them with your gamma ray, or retrieve them with your tractor beam before they hit your shield. Keep the heading gauge lined up to stay on course while watching your fuel level, reading navigation messages, and studying the Deep Space Scanner to see what's ahead. You have five warp levels for forward speed and a hyperwarp button if the action gets out of control. Now the excitement of space travel can be yours! (48K) **$21.50**

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Flying just above the ground, you will meet some of the hostile inhabitants of a strange planet. They will do their best to prevent you from reaching the enemy's home base. Control the speed and altitude of your Y-WING FIGHTER to out maneuver them and use powerful front and rear phasers when they become too aggressive. But watch out, the volcano is just ahead. (48K) **$19.50**

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You are under attack by a powerful enemy. He has many long range guided missiles and bombers all aimed at your cities. You can launch missiles from either (or both) of your launch pads to protect your cities from the onslaught of this menace. If you ever wanted to know what it feels like to be responsible for millions of (electronic) lives, now is your chance. (32K) **$17.50**

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Three missile launchers have been put under your command in a last ditch attempt to save earth. The INVASION will do their best to blow you to smithereens by dropping bombs and radioactive fallout. (32K) **$17.50**

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Go back in time to the days when England's sailing ships ruled the seas. As the captain of the "IMPETUOUS," you must contend with a mutinous crew, treasure ships, and Napoleon's French fleet **$21.50**

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The Super 89

The Heath/Zenith 88-89 CPU with a Future

SUPER 89

The Super 89 replaces the central processor board in the Heath/Zenith 88-89 series computers to bring your 88-89 to current state-of-the-art technology. The Super 89 gives you features that are useful today and allow expansion of your capabilities. The Super 89 is fully compatible with all Heath/Zenith products and also supports many peripheral devices from other manufacturers. New software and hardware are enhanced with the Super 89 by using all the features of the Z80 technology.

The Highlights of the Super 89:

- Twice the operating speed (4MHz+)
- Memory Capacity to 256 K in Software Bank Selectable 64K blocks
- CP/M and HDOS Compatible without modification
- Twice the number of expansion slots (Six)
- Real time clock on-board
- Two serial I/O Ports
- Designed for multi-user capability
- Parity checking for RAM assures integrity of memory transfer operations
- Arithmetic processor provision facilitates mathematic operations

These features, along with an enhanced monitor to access to all the Z80 CPU, give you power from your 88-89 that only large computers can claim.

High Speed Processing

The Super 89 runs twice as fast as the standard H/Z CPU board. Time savings on running programs are significant.

Expanded Memory Capacity

This feature allows you to use the advantages of the more sophisticated programming languages; enables you to use enhanced memory software such as print spoolers and electronic disks to increase speed; allows the use of "scratch pad" memory to increase efficiency; the bank select features give you high speed data handling and manipulation; and provide for multi user capabilities.

Peripheral Expansion

This important features lets you use your Super 89 in more ways with peripherals from DG, Heath and many other manufacturers. Some of these important enhancements are: Additional floppy disk controllers; Modem or Printer serial interfaces; Color video controllers; IEEE 488 BUS for test equipment and measuring interface; Analog/Digital interface; Parallel interface for high speed printers; Hard disk system controllers; Bread-board development cards; Computer game controllers; and Production process controllers.

Real Time Clock

The Real Time Clock allows you to program activities and control functions according to time; allows the use of interactive time functions with an electronic disk; and is very useful in accounting functions.

Parity Checking

This features ensures the integrity of memory transfer operations. The Super 89 alerts you if a parity error occurs.

Full CP/M and HDOS Compatibility

The Super 89 has full compatibility with either the HDOS or CP/M disk operating systems that does not require hardware modifications. This feature gives you the best of both worlds in the amount of existing software you may use.

Arithmetic Processor Provision

The Super 89 has on-board provisions for the optional AM9511A. This is a separate processor that features basic arithmetic as well as exponential, logarithmic, trigonometric and binary functions. Calculations are high speed and can be accomplished as a "hardware subroutine". This device is a must for anyone using any amount of mathematical computation whether complex functions or arithmetic calculations.

Ease of Installation

The Super 89 is simple to install and takes only minutes. No soldering required. Simply remove the old CPU board, configure and install the Super 89 to multiply the capabilities of your H/Z 88-89.

NEW SUPPORT PRODUCTS Available for the SUPER 89

Enhanced Super 89 Monitor

Gives you all the features of Heath's MTR-89 monitor plus the ability to display all the Z80 register contents; Single-step through a program and set up break-points; Supports H/Z and other manufacturers of disk systems; Improved system diagnostic routines; and Supports the Super 89 Real Time Clock.

Super 89 Electronic Disk

This optional software package for the Heath/Zenith CP/M 2.2.03 allows the Super 89 user to access auxiliary RAM as a very fast mass storage device. Provides up to 180K bytes of storage area that is accessable without the slowness of disk drives. The Electronic Disk also includes display capability for the Real Time Clock.

MP/M II™

MP/M II is a multi-user, multi-tasking operating system for use with the Super 89. Supports up to four users and the Z37, Z47 and Z67 disk systems. Compatible with CP/M software.

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Includes "Universal Dump", Intelligent Disk Dump Utility; "Universal Dup", Disk Copy Utility; and "BAD", Bad Disk Recovery Utility. $39.95 (Source: add $40.00)

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Space saving diskette back-up utility. For use with 5¼" or 8" disk systems. $39.95 (Source: add $40.00)

*** SYSCMD/plus**
A must for the serious HDOS user. Enhanced HDOS 2.0 system command processor provides extended commands and capabilities. $39.95 (Source: add $30.00)

*** Preload**
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Software driver for operation of double-sided and/or double-track double density drives with the H-17 and H-77 5¼" disk systems. Low cost alternative to high priced double density disk controllers. $19.95 (Source included).

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Circle #429 on Reader Service Card

	SuperCalc/ PeachCalc	ZenCalc	CalcStar	Multiplan	PlannerCalc	MasterPlanner	Microplan	PerfectCalc
Blank/Erase	Block	Block	Block	Block	R, C	R, C	R, C	Block
Calculation Sequence Choice	R or C first	Not required	R or C first	Not required	Fixed	Fixed	R or C first	R or C first
Copy a cell's contents	Block	Block	Range	E, R, C	R, C	R, C	E, R, C	Block
Delete row or column	R, C	R, C	R, C	R, C	R, C	R, C	R, C	R, C
Edit cell contents/formula	Yes	Yes	Must re-enter	Yes	R	R	Must re-enter	Yes
Format display control	Block	G, R, C	C	G, R, C, E	G	G, R, C	G	G, R, C
Insert row or column	R, C	R, C	R, C	R, C	R, C	R, C	R, C	R, C
Load/Transfer from external	Block*	Block	Block	Block*	Replaces	Replaces	Replaces*	Block
Merge data from another sheet	Use Load	Use Read	Use Load	Automatic	No	Consolidate	Extra cost	Merge/Consol
Move a row or column	R, C	R, C	Copy/Delete	R, C	Copy/delete	Copy/delete	R, C	R, C
Name assignment of data	No	No	No	Block	R, C	R, C	No	No
Output/Print to external dev:	Block	Block	Block	Block	Block	Block	Report	Block
Protect, Lock cell(s)	Block	No	Block	Block/formula	Select Input	Select Input	Program	No
Replicate with auto-adjust	Cell-to-Block	Range-to-Block	Cell-to-Block	Cell-to-Block	R-to-R,C-to-C	R-to-R,C-to-C	Automatic	Block-to-Block
Save/Transfer to storage dev:	All, Values	All	All, Values	All	All	All	All / table	All
Sort data on worksheet	No	No	No	Rows by Col	No	No	No	No
Title (lock top/left margins)	Variable R,C	Rl &/or Cl	Variable R,C	Variable R,C	Fixed	Fixed	Fixed	Rl &/or Cl
Window/Split page display	H/V 2 pages	H/V 2 pages	None	H/V 8 pages	H/V 2 pages	H/V 2 pages	None	H/V 2 pages

This table provides information concerning the functions you can perform from command mode in each package. These commands are used to simplify and speed the setup of a given sheet. Generally, commands that work on blocks of cells are more flexible than those limited to a whole row or column.

Key to abbreviations:

R = horizontal Row
C = vertical Column
E = single cell Entry
G = global
range = full or partial Row or Column
fixed = can't be changed
block = rectangular group of cells any size
H/V = horizontal/vertical

*indicates that package can also call up directory of disk being copied from.

Command Statistics

Walt Bilofsky's Software Toolworks, and probably have several of his offerings. Bob Wesson's ZenCalc is written expressly for the Heath/Zenith line, and is unique in that it is available in either CP/M or HDOS versions. Having been written specifically for the Heath/Zenith computer systems, ZenCalc uses the H19 keypad and special function keys extensively. If you've used the Toolworks' PIE editor, you'll recognize many of the commands and keyboard technique.

I tried both the HDOS and CP/M versions, and will make only one comment regarding the HDOS version: If you use a lot of device drivers, tasks, or other system overhead, you won't have much room left for ZenCalc data. I've got hard and soft-sector disk drives, a custom Epson printer device driver, and a couple of tasks using up memory when I run HDOS, and found myself very restricted in ZenCalc.

Bob Wesson sent me a pre-release copy of ZenCalc for CP/M that cleaned up a couple of earlier bugs. If you've dealt with Walt Bilofsky's Toolworks, you'll be familiar with the reasonable $10 update policy.

ZenCalc has the ultimate greatest in keystroke-cutting technology. Every function key, including the shifted keypad keys, yields some helpful processing. PIE users will feel right at home with the red PICK-UP and white PUT-DOWN keys for moving and copying data. I especially liked the special functions provided by the ENTER key, which caused a command to be prefixed with additional data: you can enter a count to have a function performed multiple times, use the cursor keys to plug a cell name into a formula, or initiate special processing functions.

When you save a ZenCalc file, the output is an ASCII file, easy to decode. It's possible to interface the file to any other application language, both to and from ZenCalc. An unfortunate drawback to the ASCII format is a slow load time when you read it into ZenCalc, as evidenced by the benchmark runs.

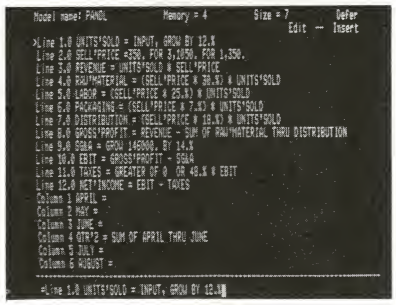
ZenCalc's processing speed was excellent in some ways, rather dismal in others. Though I had automatic recalculation suppressed, each time I replicated data through a column of cells, ZenCalc insisted on recalculating the values of those cells. In fact, two passes were made through the worksheet for each replication if automatic recalculation was enabled.

Cursor control was more natural and logical, with shifted cursors causing movement to the margin selected. Paging was simple. One nagging problem was that ZenCalc did not monitor the keypad as it painted a new screen. Other software tested caught the keyboard request, and interrupted painting to proceed to the next requested cell. With ZenCalc, you are obliged to wait for each screen to paint. The work-around, obviously, is to use ZenCalc's paging function keys, or its "=goto" direct addressing capability.

In all, ZenCalc is well written, takes full advantage of the professional H19 keyboard, can interface with other applications, and is distributed in most Heath-compatible disk formats. Perhaps the best part is the price. For several years the Software Toolworks has striven for high-quality, low-priced software for the hobbyist. It appears they've crossed over into the professional market with ZenCalc. When you compare it to the competition in price vs. performance, it looks mighty nice.

PlannerCalc *and* MasterPlanner *by Comshare Target Software*

So who's ever heard of Target software? I surely hadn't before I saw the ad in a computer retailing magazine. Anyone with the guts to offer a "calc" package for fifty bucks deserves a chance to get raked over the coals with the big guys. Bob Jaric, national sales manager for Comshare Target, only fueled the fire with his optimistic promises of a fine piece of software. He even offered to send MasterPlanner, the upgrade from PlannerCalc for the advanced user.


Model name: PANDL Memory = 4 Size = 7 Defer
Edit -- Insert
>Line 1.0 UNITS'SOLD = INPUT, GROW BY 12.5
Line 2.0 SELL'PRICE =250, FOR 3,1050, FOR 1,350.
Line 3.0 REVENUE = UNITS'SOLD @ SELL'PRICE
Line 4.0 RAW'MATERIAL = (SELL'PRICE @ 30.5) @ UNITS'SOLD
Line 5.0 LABOR = (SELL'PRICE @ 25.0) @ UNITS'SOLD
Line 6.0 PACKAGING = (SELL'PRICE @ 7.0) @ UNITS'SOLD
Line 7.0 DISTRIBUTION = (SELL'PRICE @ 10.0) @ UNITS'SOLD
Line 8.0 GROSS'PROFIT = REVENUE - SUM OF RAW'MATERIAL THRU DISTRIBUTION
Line 9.0 SG&A = GROW 140000, BY 14.0
Line 10.0 EBIT = GROSS'PROFIT - SG&A
Line 11.0 TAXES = GREATER OF 0 OR 48.0 @ EBIT
Line 12.0 NET'INCOME = EBIT - TAXES
Column 1 APRIL =
Column 2 MAY =
Column 3 JUNE =
Column 4 QTR'2 = SUM OF APRIL THRU JUNE
Column 5 JULY =
Column 6 AUGUST =
=Line 1.0 UNITS'SOLD = INPUT, GROW BY 12.5
Courtesy of Comshare Target

MasterPlanner offers two ways to write a report. One option, as this screen display shows, is to use a stylized form of textual report description.

That's hardly an objective start for this particular review, but I'm only human. When the stuff arrived and I had a chance to look at it, I started to chuckle. *This doesn't sound like a proper "calc" package!* I found myself musing as I scanned the documentation.

It does have an offbeat screen format. Don't let that put you off. PlannerCalc is designed for writing financial reports, and it does that job very well. It is not cell-oriented, but line- and column-oriented. If you've become familiar with the other "calc" programs, it takes some re-learning to use PlannerCalc effectively. Once you make the transition, it comes naturally. I got to like it quickly.

A lot of nice automatic functions are included for forecasting, including GROW, PRESENT-VALUE, AVE, and SUM, such as the other packages offer. A powerful IF-THEN-ELSE capability is included. And a glance at the benchmark runs will

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		SuperCalc/ PeachCalc	ZenCalc	CalcStar	Multiplan	PlannerCalc	MasterPlanner	Microplan	PerfectCalc
Program Load time	2 MHz	0:06	0:06	0:13	0:29	0:11	0:13	0:17	0:08
	4 MHz	0:06	0:05	0:10	0:13	0:09	0:12	0:14	0:08
Memory Available	Start	28	22,133	449	100%	16	23	N/A	14/0
	Loaded	14	11,802	49	50%	11	18	N/A	14/0
	% Used	50%	53% *	89%	50%	31%	22%	N/A	0%
BENCH1 Load time	2 MHz	1:16	2:41	1:20	0:19	0:06	0:24	0:10	2:56
	4 MHz	0:37	1:19	0:41	0:07	0:035	0:21	0:07	1:26
BENCH1 Calculate Time	2 MHz	1:00	1:24	3:55	1:06	3:00	1:23	0:19	1:24
	4 MHz	0:30	0:39	1:38	0:32	1:28	0:43	0:12	0:40
BENCH1 File Size		16K	8K	18K	8K (12K ASC)	4K	2K	4K	6K

Benchmark Results—BENCH 1

The benchmark is a useful tool to compare the performance of several similar programs. The technique used was to design a spreadsheet with enough calculations to provide reasonable timings, then enter it into each program. The first benchmark program consists of four columns of 100 cells. Row 1 Column 1 was the number 1010, and subsequent column 1 entries were merely incremented by 1 from that. Column 2 is the value of column 1 multiplied by a constant 2. Column 3 checks out the function LN(x), using the number in column 1 as the argument to the function. The last column merely sums the values in the first three columns using the built-in SUM function, if one exists. In all cases, all four columns were set to 15 characters wide, 5 digits of precision (if possible).

Tests were run at both 2 Mhz and 4 Mhz. Disk-bound processes did not differ much between the two speeds, whereas the processor-bound functions should have doubled in speed.

Entries marked with an asterisk are discussed in the text.

convince you that it's quick at arithmetic.

I missed the math functions most other packages offer: POWERS and trigonometric functions (SIN, TAN, COS). Averages must be computed on a line or column basis, and you don't have near the flexibility of other packages in designing your own worksheet layout. Data can be referred to by cell address, but a lot of the PlannerCalc syntax for writing reports revolves around naming an entire column or line by some descriptive title, and using that title in formulas.

MasterPlanner is more of the same, with a lot of bells and whistles. The basic package remains the same, however. What you get for your extra money is a lot more space for reporting, better control over formats and print selection, and more built-in functions for modelling. Personally, I think the fifty dollar package is just fine.

A nifty MasterPlanner feature is that you have two ways to write a report. You can fill in the lines in a manner similar to the other "calc" programs, with cursor movement and all. Or you can use the stylized, sort of textual report description of which I became very fond. If you had a new secretary, and wanted a financial report typed up, your instructions would look remarkably like the textual format of a MasterPlanner worksheet.

Comshare Target is out to sell a bunch of these PlannerCalc disks. At fifty dollars a copy, they'll do it! I've seen display racks locally full of them, but not one copy for the Heath/Zenith system. But they have catered to the Heath market specifically by providing Heath 5¼" hard-sector disks, the only supplier besides Walt Bilofsky's Toolworks to do so. If you're doing management reports, and want to bat one out quickly, this may be the package to choose.

[*Editor's note:* There has been a price increase since this was written. Please check the general information chart for the current price.]

CalcStar *from MicroPro International*

If you're a serious business user of microcomputers, you've probably come in contact with one of MicroPro's fine software products: WordStar, DataStar, WordPro, and SuperSort. In each, the high standards, excellent features, and professional documentation is obvious. From that standpoint, CalcStar is in the same class as the rest. CalcStar keeps its menu at the top of the screen (*a la* WordStar) for display of user options. You can, of course, remove the menu to provide for more data area. As you choose a command, CalcStar requests more information as needed.

CalcStar is not offered through Heath, though many Heathkit stores carry it independently. I was a little

surprised to find that MicroPro's Heath configuration used the same old CTRL-E-S-D-X key sequences that WordStar uses for cursor control (up, left right, down, respectively). I spent about 45 minutes figuring out how to define the keypad keys for cursor control. Once done, I saved the configuration permanently as one of the installation options. To be fair, I should point out that I tested a pre-release version of CalcStar, and MicroPro may (by now) have properly configured the H19 keypad. The documentation implies, however, that the CTRL sequences are recommended for compatibility with the other *Star* products.

The initial tutorial in the manual, along with the sample files on the disk, were fine for introduction to some of the features of CalcStar. Start out with the fact that CalcStar has a *calculator* mode that allows you to enter data and formulas without putting them in the worksheet itself—and get immediate results. You can save information on the worksheet for a scratchpad, and use it in future calculations. CalcStar handles up to 14 decimal places of accuracy, 12 of which are displayable. I especially liked the way the ;Load command displays a progress-ticker while it's retrieving data from disk. It gives you some reinforcement that something is indeed going on.

CalcStar's delayed recalculation also keeps you informed of its progress with a counter in the lower left corner of the screen showing the line or column being recalculated. I guess I'm a sucker for gadgets, but I like to *see* that something's going on; it's a nice touch. Unfortunately, the indicator does not show up when you replicate a column or line, sometimes a lengthy process.

The size of the data area is smaller than most. When you scroll to an off-screen cell, the entire display area is repainted on the screen. When a scroll *is* required, however, CalcStar positions a half-page (instead of just one column or row) in the scroll direction, reducing the number of repaints. This is another program that ignores the keyboard while painting a screen, a surprise if you've ever used the smooth WordStar.

CalcStar's biggest disappointment was speed. In comparison with the other packages tested, and even other MicroPro software, this one is the pits! One glance at the benchmarks will show that CalcStar misses the mark completely in doing what one of these programs should do best: calculate. I finally gave up on the benchmark after nearly 40 minutes of grinding, and the others were dismally slow. Hopefully, the version released will have some speed improvements. Another drawback was CalcStar's memory usage in the benchmark, higher than any other.

Performance aside (as it will surely improve with future releases), CalcStar is up to MicroPro's standards. If you're using other MicroPro products, staying with one vendor may be beneficial, and I'd have few reservations about using this one.

Multiplan *by Microsoft*

Microsoft has been a boon to the microcomputing industry. They gave us the first standardized BASIC implementation, a fine BASIC compiler, the first practical COBOL compiler with most ANSI COBOL features, and a wealth of other contributions. When the micro industry gets a good look at Multiplan, it will be no exception.

Multiplan has a big plus over the other programs reviewed: Microsoft has already implemented a 16-bit version of this for the new Zenith Z100 series microcomputers. Multiplan, therefore, will afford simple guaranteed upgradability of your worksheets when you're ready to spend the money for eight more bits of processing power.

That fact would lead one to suspect that the 8080-version of the software would be a cross-compiled (hence *slow*) mess similar to the first Microsoft BASIC implemented on the IBM PC. If so, someone did a fine job hiding it, because this package is very quick in most calculations. The speed advantage

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SIN	:42	1:29	N/A	:13	N/A	N/A	N/A	1:29
SQRT	:29	1:02	N/A	:21	N/A	N/A	N/A	1:03
Ln	:52	1:02	N/A	:22	N/A	N/A	:21	1:04
LOG10	:50	1:00	N/A	:21	N/A	N/A	N/A	1:01
+ 500	:02	:07	1:25	:04	---	:23	:01	:09
- 500	:025	:07	1:25	:04	---	:23	:01	:09
* 500	:025	:09	1:25	:04	---	:23	:01	:10
/ 500	:035	:09	1:27	:04	---	:24	:04	:11
n^4 (**4)	1:47	:27	2:31	:29	N/A	N/A	N/A	:27
n*n*n*n	:045	:17	2:22	:05	---	:26	:04	:17
AVG(200n)	1:30	6:45	38:00+ *	2:29	---	---	N/A	N/A

Benchmark Results—BENCH 2

The second benchmark was written to test the speed of each of the listed functions below. Not all functions were supported by each package, and those columns are marked "N/A" for not available. The same notation is used if the particular package did not allow a particular test to be validly made.

The program consisted of the numbers 1-200 in column 1, while column 2 contained the function to be tested, 200 times using column 1 as the argument value to the function. It was noted that exponential routines were typically slow, so both the exponent function (n *x*) and the standard algebraic technique (n*n*n*n) were compared. The last test involved using the built-in average function to obtain the average of column 1 (all rows) 200 times.

Entries marked with an asterisk are discussed in the text.

makes it eminently more "friendly" to the user. Only SuperCalc provides similar computing speed. I did notice, however, a considerable time lag when scrolling through large tables of alphanumeric data.

Like CalcStar, Multiplan keeps you posted while it's doing the grinding work. I loved the countdown to completion on a recalculation.

I had to fiddle around a bit with the configuration program to get Multiplan to use the H19 keypad, but got it done in about twenty minutes. They allow for the fact you might want to reconfigure and make it easier for you than do most others. Also, a nice feature is the ability to choose the format of the current cell indicator, in case your terminal doesn't have reverse video.

The documentation with Multiplan is extensive, heavy on tutorial, and includes a handy reference card. Some unique features include the ability to Sort rows on the worksheet (but it's pretty slow); a powerful IF-THEN-ELSE capability that allows recursive calculations; a fine implementation of table-lookup; and an external file structure called SYMLNK that is supposed to interface with other languages. On the last, I'd prefer a standard ASCII file like ZenCalc uses. The SYMLNK formats are not simple enough for the non-programmer to use comfortably.

I don't like the way Multiplan ignores CP/M's type-ahead buffer (TAB). Microsoft informed me that, by design, Multiplan empties the TAB when it finishes painting a screen, then accepts a few characters. So holding the REPEAT key makes for a not-so-smooth scroll across or down the page. The initial load time for the Microplan program was nearly half a minute, too long in my book. I didn't like the way text data was truncated if it didn't fit in the cell. Other packages allow text to overflow if the adjacent cell is empty.

I liked the format of the menu. You get a master menu, with complete English words, from which you can make a choice using the cursor or by typing the first letter of the desired command. That, in turn gives you another English, fill-in-the-blank submenu. It's all very nice, especially for the new user. Once you learn about the basic commands, you can work your way around pretty well without a manual. Only SuperCalc's menu handling impressed me as much. The Help facility was excellent and easy to use.

I suppose Microsoft figured that if a two-way screen split capability was good, an eight-way split would be better. To be sure, allowing up to eight different windows on your data is powerful. Once you have more than four windows, however, the screen begins to look confusing. You do have the option of enclosing each window with a graphics

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border for more separation.

Probably the best feature of Multiplan is the ease with which you can carry data lines forward from one worksheet to another. The lines carried forward are labelled with a descriptive name, and a reference to that name in a subsequent worksheet just brings in that line where needed. It'll make for an excellent tax forms or general ledger type of application.

Multiplan's not cheap, so it should perform as well as it does. By the time you read this, the CP/M version should be available. If you're planning on a future upgrade to a 16-bit machine, this one will grow with you. If you're lucky enough to be starting out on a Z100, you'll want to look at the 16-bit version under MS/DOS now.

MicroPlan *by Chang Labs*

I've got to admit, I never heard of Chang Labs, nor of MicroPlan until just a month before editorial deadline. Beware, it's a sleeper! MicroPlan is most similar to PlannerCalc in that it is more line-and-column-oriented than cell-oriented, though the user can address each cell individually if desired. Its commands make final-form printouts look very professional, indeed. And it has one major feature no other package reviewed offers.

Most impressive was MicroPlan's speed of recalculation. It beats the rest in calculations it *can* do, with the exception of division, and is no slouch there, either. Unfortunately, MicroPlan is limited in its available functions. It is aimed directly at the businessman who is focussing on modelling and forecasting, not the user who needs a general-purpose, scientific, or engineering worksheet.

I got both MicroPlan and ProfitPlan from Chang Labs in the demonstration packet, as well as an optional software extension to MicroPlan called Extended Tables. The extension provides file linking capabilities with external applications programs, as well as selective retrieval of data from other MicroPlan files stored on disk. From all appearances, ProfitPlan is a trimmed-down version of MicroPlan, offered at a lower price.

At first I didn't care for MicroPlan's menu. You're required to type in the number corresponding to the menu item you wish to select. I like words, not numbers. But I got used to using the numbers, and it's easy to scan the menu for more options. Help is available by typing a "7", then the menu number of the function. I wasn't impressed with the Help files, though. In some cases, I had to refer back to the manual even though I had read it earlier, because the Help information was insufficient. The Help available for the more sophisticated functions was much too brief.

The left-hand margin is used for line-labelling, and can't be scrolled off the screen, though its width can be varied. The right-hand margin contains a portion of the Help menu. The result is a smaller user display area. You can scroll in any direction. Print line formatting is more sophisticated than most others with underlines, commas, dollar signs, blank-when-zero, and other formatting commands optional. There is an alternate output format that clearly describes all the parameters defined for the spreadsheet. I prefer this particular format to all other formula dump formats except those of PlannerCalc/MasterPlanner.

The Heath owner continues to be insulted with those standard CTRL-E-S-D-X cursor movement keys. I found no simple way of implementing the alternate keypad, so I played with one of the files the installation program CUSTOM.COM creates. You can, with the escape-sequence chart and a little ingenuity, reconfigure MicroPlan to honor the H19 keypad. I just don't understand why most manufacturers think the H19 has only 36 keys and huge CTRL key.

I said MicroPlan was a sleeper with a unique feature. This is the only program tested that allowed certain commands to be stored and executed. In layman's terms, it's *programmable*. Anyone with appropriate study can set up a program to build a single worksheet, and then carry information from it forward to other sheets without intervention. I've wished and wished for this feature in other spreadsheet programs. Although using the programming feature makes the overall task a little more complicated, it's optional, so you don't have to use it.

The extra-cost Extended Tables option provides functions like Merge, Consolidate, and others. Why this is extra cost from Chang when most other packages include it automatically escapes me. Perhaps it's a marketing ploy, but why would someone spend the base price without spending a little extra for the options?

There are many pre-programmed functions and models for financial applications, math, and statistical analysis that are included. I was impressed with the amortization schedule and the cash-flow and tax-shelter analysis for the purchase of real estate.

MicroPlan's downside was the format of the menu and user interface, which is not quite as natural as I like. It's "user friendly" all right, but from a different part of the country, therefore unfamiliar. The reference guide was too brief to be useful. There were some functions (notably the statistical functions) that were not documented at all.

I did find MicroPlan to be very fast, with excellent tutorials, and a lot of power. CPAs or bookkeepers would love

to have this software in their toolbox. For hobbyists or engineers, it may be overpriced for its features.

PerfectCalc *from Perfect Software*

All the major software suppliers want to cash in on the "calc" program market, and Perfect Software is no exception. They're the suppliers of PerfectWriter, a sophisticated word processing package. PerfectCalc is obviously meant to be a companion to PerfectWriter, since it uses most of the same technology offered in PerfectWriter.

The most obvious similarity, and a real help to PerfectWriter owners, is in the control sequences and overall program structures. Virtual memory is implemented, giving the user a full 64K of memory for data. Due to the increased storage available, PerfectCalc allows more than one worksheet to reside in memory at one time, and allows the user to switch between them.

I'll have to admit, I've never used PerfectWriter. The control sequences are not to my liking. Why require *two* control characters (e.g., CTRL-X CTRL-C to exit the program) when one will do? Now, I did test a pre-release version of the software, and the documentation was not the final form. It's possible that the configuration program allows me to choose other control sequences.

I really liked some features PerfectCalc offers. When you delete one or more cells, they're copied into what is referred to as the "kill buffer." This storage area can subsequently be accessed to retrieve data into other cells. It's a technique used in file editors often, but this feature in spreadsheet programs is offered in only one other package tested (ZenCalc).

I don't like having to distinguish between upper- and lower-case letters for column names, a trait shared with ZenCalc. I probably should note here for the record that ZenCalc and PerfectCalc have much in common, most significantly the author, Bob Wesson. Though PerfectCalc has a different program structure and nomenclature, you'll recognize Bob's professional approach throughout it. Due to the ASCII format (another trait shared with ZenCalc), you'll also note the slow file load speed—a regrettable tradeoff you have to accept if you have to exchange data with other programming languages.

In the speed department, PerfectCalc was appropriately responsive. It's written in "C", and several authors assured me that "C" is the language used to implement most of the new software coming out these days. If so, it would benefit from a better implementation of the compiler for numeric calculations to put it in the really quick category. Aside from some bugs in the pre-release version that I helped discover, it worked fine. Owners of PerfectWriter will surely appreciate the familiar environment PerfectCalc provides.

Conclusions

In the first issue of *Sextant* (Spring 1982), I reviewed a number of print spoolers and came up with no clear winner. *This time*, I can exercise my prerogative as a reviewer. Often it's hard to look at all the different offerings, and come out and say, "This is *it*!" Not so, this time. If your budget can handle the cost, Microsoft's Multiplan wins this race by a couple of lengths. I am impressed by the professional feel it provides. I predict that within a year there will be several applications packages written in and around Multiplan, as it is so flexible and powerful. This is not to say the other "calc" programs aren't good. Each has its benefits, and you can easily shop price-performance. The only real disappointments were CalcStar's processing speed and the slow file load speeds exhibited by ZenCalc and PerfectCalc (which last, like SYMLNK's complex formats, is something some of you may gladly accept as a necessary tradeoff if you want your worksheet to communicate readily with other programming languages). We'll have to hope those problems have been resolved in more current releases.

Alphabetical listing of products and supplier addresses

CalcStar—MicroPro International Corporation, 101 Lucas Valley Road, San Rafael, CA 94903.
MicroPlan—Chang Laboratories, Inc., 10228 North Stelling Road, Cupertino, CA 95014.
Multiplan—Microsoft Corp., 10700 Northup Way, Bellevue, WA 98004.
PeachCalc—Peachtree Software Co., 3 Corporate Square, Suite 700, Atlanta, GA 30329.
PerfectCalc—Perfect Software Corp., 1400 Shattuck, Berkeley, CA 94709.
PlannerCalc and **MasterPlanner**—Comshare Target, 1935 Cliff Valley Way N.E., Suite 200, Atlanta, GA 30329.
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ZenCalc—The Software Toolworks, 14478 Glorietta Drive, Sherman Oaks, CA 91423.

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T & E associates: "Just Home Folks" Implementing HDOS Utilities

Frederick Zimmerman

In a recent interview with *Sextant*, Tom Cauthen, president of T & E associates, described himself and his colleagues as "just home folks," as he put it in his Georgia drawl. After a long interview with Mr. Cauthen and colleagues, I disagreed. T & E associates impressed me as a very professional software firm which brings many strengths to a competitive marketplace.

T & E is located in Millersville, Maryland, and has a local staff of five full-time and six part-time employees. The company is affiliated with software design organizations in other areas, including Creative Resources and Software Helpline of Houston, Texas. Although it does some software development in-house, it is primarily a software distribution and support company.

T & E and Heath/Zenith

There is a French word, *les grognardes*, which Napoleon used to describe the most experienced veterans of his Imperial Army. It means literally "the grumblers." He used it to refer to the people who knew how to get the job done — and who weren't timid about letting him know when they saw things being fouled up. If Napoleon was involved in the microcomputing industry today, he would surely call Art Tomaszewski *un grognard*. In 1975, Tomaszewski purchased one of the first hundred Altair microcomputer kits produced. He bought an H89 in 1981, intending to use it for sophisticated music programming and work on artificial intelligence. Instead, he "fell in love with HDOS," the Heath Disk Operating System written by J. Gordon Letwin.

At the same time, Becky Cauthen had assembled an H8 to use in conjunction with her Bally graphics computer. She had been writing software "since before the word was invented." Her first computing experience was with an IBM 1604, an IBM mainframe of the early sixties, so she might well be classified as *une grognarde* of the computing industry. When she and Tom also became impressed with HDOS, and they got together with Tomaszewski, it was natural that *les grognardes* should start asking, "Hey, what's missing?" In other words, what was normally available on a mainframe which wasn't available on HDOS? In 1981 T & E associates began producing and marketing utilities for HDOS.

(Tom Cauthen explained to us that the reason "associates" is spelled with a small "a" is simply to make a pleasing contrast with the large block capitals of "T & E.")

In our recent interview, Cauthen consistently emphasized T & E's detailed knowledge of HDOS as perhaps the most important selling point for their software. "We think we have a better understanding of HDOS than anyone else around," he said. "We have disassembled HDOS from version 1.0."

As the folks at T & E have gone about their business of developing software, they have written quite a few HDOS utilities for their own use.

Indeed, Cauthen claims that T & E is more faithful to HDOS than any other programming firm. Ironically, he says, this fidelity has been misinterpreted as a weakness in T & E software. This subject arose because of an article by Ken Patrick in the premiere issue of *Sextant*, in which he reported encountering difficulties getting Microsoft BASIC to write a file while using T & E's print-spooling program, Multi-Print. Patrick said, "T & E attempted to point the finger at Microsoft's memory management routines." In another case, Patrick was "unable to save a file" from the popular word-processing program PIE, and "again, T & E thought PIE was the culprit."

Hugh Kenner made a similar report in *Sextant*'s

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EP: will print all of the Heath graphic characters, in regular and inverse, but that's just the beginning. EP: also emulates all of the important screen formatting escape sequences of the H19/H89 terminal, such as direct cursor addressing, erasing, editing, transmit functions, and much more.

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ES: is also available for use with serial interfaces, but features all of the power of the EP: driver. Both of these drivers require HDOS and an Epson printer with the Graftrax option. Graftrax requires a 2K serial buffer, or a parallel interface to operate. Software and full documentation is supplied on 5.25 inch single density diskette.

EP: Parallel Epson Printer Device Driver	$20.00
ES: Serial Epson Printer Device Driver	$25.00

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Fall 1982 issue. "Only one nuisance: to use this driver [Multi-Print] with any version of TEXT before 4.0., you should explicitly load it into memory with LOAD LP:, or everything may lock up. T & E's Tom Cauthen blames a bug in TEXT. I've not asked TEXT's Jim Gillogly what he blames." It is difficult to know how to evaluate these remarks. However, there is one significant piece of evidence which strongly supports Cauthen's argument: the problem in question does *not* arise in TEXT 4.0, the latest version. In the absence of decisive evidence either way, perhaps the fairest solution is to leave the final word to Cauthen: "We *don't* modify HDOS."

Some T & E products

T & E sells a wide variety of utility programs, including Multi-Print, the print-spooler mentioned above. Their device drivers, which support several different brands of printers, have been among their most important products. Becky Cauthen said that the introduction of the device driver software marked a turning point. (Although Tom was quick to point out that "T & E has been profit-making from Day One.") Part of the reason the device drivers have sold well has been the popular Ecoset feature. "Ecoset is loved," said Cauthen. It enables the user to display the values of the driver option settings.

Another popular product is a program which transfers TRS-80 disk files to HDOS format. Similar programs are available to convert IBM- and Osborne I-formatted disks. Becky Cauthen said the TRS-80 program was T & E's "hottest selling item right now."

They also offer Heath/Zenith users a Disk Format Program, which allows the user to control the number of disk sectors devoted to the directory, freeing up space for other purposes. It also takes up less space than the Heath program it replaces. In addition, T & E gave *Sextant* an exclusive, hour-long demonstration of a program which takes disk files created on Exxon Office Systems' Qyx intelligent typewriters and converts those files into HDOS files. This is no easy task. For one thing, Heath disks have 10 sectors, and Qyx disks have 16. For another, Qyx disks rotate *backwards*.

There is only a limited market for such a program. Indeed, so far as we know, *Buss* and *Sextant* are the only organizations in the Heath/ Zenith world which use the Qyx typewriter. Tomaszewski, who wrote the program, knew that this was the case, of course. The primary motive behind this Qyxotic venture was to demonstrate T & E's ability to interface Heath/ Zenith products with many different types of hardware.

Support

I asked Cauthen about T & E's support policies. He explained that T & E has a strong incentive to provide good support: "We have to

keep our creative people from being inundated with phone calls," referring to T & E's out-of-house software designers. Becky Cauthen showed us some questionnaires which are enclosed with each T & E product. Buyers are requested to answer questions about how the product performs,

Cauthen consistently emphasized T & E's detailed knowledge of HDOS as perhaps the most important selling point for their software.

whether it has lived up to expectations, what new products they would like to see, etc.

I had a chance to see some sample returned questionnaires, and the questions seemed to cover most of the relevant subjects. As is usual with such surveys, the answers varied considerably in utility, from terse and uninformative ("yes," "no," "fair") to article-length essays. Overall, the questionnaires seem to serve the valuable purpose of keeping T & E aware of its customers' interests and preferences.

The T & E associates empire

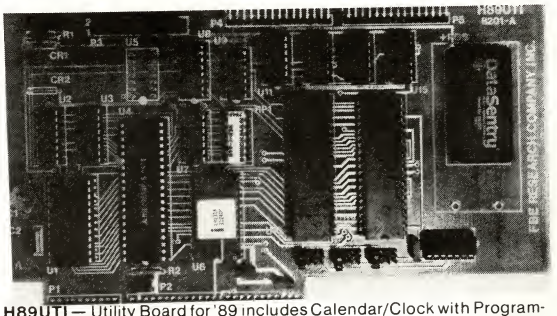
The T & E associates "empire" (a word Cauthen used with tongue firmly in cheek) has tentacles stretching all the way to Texas. T & E acts as distributor for Creative Resources, a programming firm based in Houston, Texas. I talked to the founder, David Clark. He's a professional programmer who works as a consultant for Sperry Univac. He bought an H8 as soon as it was announced in the Heathkit catalog, and quickly became interested in HDOS. Clark's written several HDOS utilities, including T & E's print spooling program. He's the one who "disassembled HDOS from version 1.0" — and, he says, "I know an awful lot about it."

Clark is also the founder of Software Helpline, a firm which provides technical advice to microcomputer owners. It is still a rather small entity, Clark says, so perhaps its greatest importance is in its relationship with T & E associates. Tom Cauthen said, "No matter how strongly T & E believes in a modification" to a product, if Software Helpline doesn't like it, T & E doesn't do it. Clark said, "I have a lot of respect for Tom's promotional ability, and he has a lot of respect for my programming ability." This mutual respect seems to be a sound foundation for cooperation.

Future products: Son of HDOS?

Cauthen talked at length about some of the projects currently under development at T & E as-

from FBE-H89UTI



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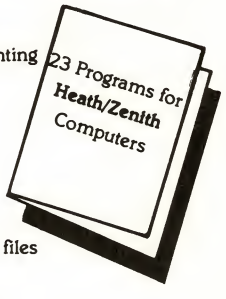

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sociates. They are working on an editor which will have sophisticated features such as multiple do loops and split screen operation.

Multiple do loops would give the user the ability to repeat a series of commands with one keystroke. More strictly, Cauthen explained, do loops define macros. What's a macro? It's a series of commands that are recognized by the application software or operating system. I'm new to computers, so I found the inner workings complicated. But the effect of having do loops is to make things a lot simpler. For example, consider the case of an author who wanted to insert the word "disk" into many different places in his article. Without do loops, he would have to move the cursor to the appropriate location, hit the insert character key, "d," "i," "s," "k," hit space, move the cursor to the next location, and repeat the process. With do loops, the author could dedicate the "F1" key to the sequence of strokes "IC," "d," "i," "s," "k," space, and "IC" again (to return the screen to normal status). Then all that would be necessary would be to move the cursor to the desired location, hit "F1," and move on to the next location.

Split screen operation would enable the user to create two columns on the H19 video screen. The user could specify their widths; for example, one column could be 60 characters wide and the other 20 characters wide. Alternately, the user could create as many as four "row boxes" among which 24 rows on the H19 screen could be divided into, for example, four "row boxes" of six lines each.

Cauthen says, "We can take existing PIE and cut it down to 10 or 11 sectors instead of 21. We've proved it to ourselves." T & E claims that it can therefore create an editor which is more powerful than Software Toolworks' PIE but occupies the same space. They also plan to make this editor available for a price "in the $50 to $75 class," which would make the cost of a total word processing package about $100.

As the folks at T & E have gone about their business of developing software, they have written quite a few HDOS utilities for their own use. Several such "offspring" make up one software product which T & E might release in 1983: an "enhancement package" composed of five to seven modules. One of the modules, for example, might enable the function keys to reset the screen, or cause the computer to print out exactly what is on the screen (no more, no less), performing in much the same way as the CTRL-P function of CP/M. Another possibility is a module giving the H19 "soft" function keys similar to those on the Osborne I. That is, function keys which can store user-programmed commands (for example, "PRINT:X=0:Y=0") that one might want to insert into a program, or use to give direct instructions to the computer in command

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SERIAL, PARALLEL & REAL TIME CLOCK FOR H89

The 2S+2P+RTC is a board that replaces the serial board in the Heath/Zenith H88/H89 and provides the following:

2-serial input/output ports that are software and cable equivalent to the H88-2 and one port less than the H88-3. Both serial ports can be configured as a DCE or DTE port.

2-parallel input/output ports: 16 bits output and 16 bits input plus handshaking lines. Four of the input bits may be used as status signals. An optional cable is available for Centronics parallel I/O.

RTC-real time clock with 1/100th sec, 1/10th sec, seconds, minutes, hours, day of week, day of month, and month counters. May be programmed to interrupt on alarm, or every 1/10th of sec, sec, minute, hour, day, month or never. Optional on board battery and charger will keep the clock running for months.

The 2S+2P+RTC board comes with instructions and program listings in assembly and BASIC source to use the parallel and real time clock.

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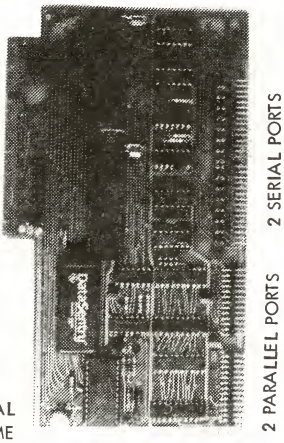

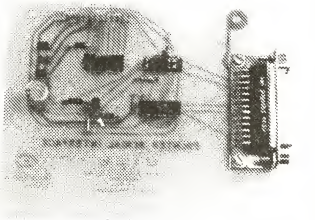

EPSON Serial Interface Board

PRICE LIST	List Price
2S+2P+RTC without UART's and RS232 ic's for those customers that have existing serial boards	$110.00
2S+2P+RTC with UART's and RS232 ic's	$155.00
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Centronics parallel cable to Printer (six feet long-2S+2P+RTC connector and Centronics connector on other)	$ 50.00
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mode. Cauthen says that the chief problem with releasing the enhancement modules as they stand is that only four or five modules meet T & E's standards for publication, and they want the package to contain *seven* modules.

Sextant had some interesting off-the-record discussions with Tom Cauthen. Naturally, we can't reveal the substance of those remarks, which covered a variety of subjects. But we *are* authorized to say, on the record, that T & E associates is "contemplating a Son of HDOS."

T & E looks at the microcomputing market

"I will say that I am very concerned about the Z100 series," said Cauthen. Since he distributes software for Zenith computer systems, it's understandable that he didn't want to go into detail about the nature of his concern. He appeared to be worried primarily about the price competition the Z100 series might face. (See the Summer *Sextant* for a description of the Z100 series of Heath/Zenith computers.)

He did want to praise Zenith for "making two smart moves by using the S100 bus" and basing their disk operating system on the Microsoft Disk Operating System (MS-DOS), which is compatible with the IBM Personal Computer's disk operating system. The S100 bus — which connects the auxiliary circuit cards that provide internal function expansion and support peripherals such as printers, etc. — is an "industry standard," which means that it is compatible with many products on the market.

I wonder if Heath/Zenith remembers the flak Heath took five years ago when they introduced their H8 computer with a Heath-designed bus which was not compatible with S100-compatible products. It may be that Heath is determined to avoid making the same error again, in much the same way as an elephant might react after stubbing its toe. It takes *time* for the neural impulses to get all the way up to the brain and then back down again, but once an elephant learns how to avoid a mistake, it *never* forgets.

Just home folks

I don't think Cauthen forgets much, either. T & E associates impressed me as a savvy organization. It hasn't grown to elephant size yet, but it looks as if it can carry its weight in the Heath/Zenith marketplace, thanks to Tom Cauthen and his crew of "just home folks."

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89/STAR: ALL H89/H19 SPECIAL FUNCTION and KEYPAD keys come alive for WordStar™ users. You will have no more need for the "control" key to move the cursor or execute any command. Package includes a prologue program for labeling the 25th line, and a self-installing patch to WordStar (specify version). $29 ($2 manual only).

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FLIGHT SIMULATOR: This is a simulator, not a game. It's tough and it takes some time to learn. Using your full screen instrument panel mockup, fly in either a glider, trainer, or 747. You define your runway and wind conditions, so when you get better, the going gets rougher. This program features some heavy aeronautical number crunching. It's fast, accurate, and challenging. After making coordinated turns, using your incremental flaps, or precisely flaring the 747 in a dead-stick landing, you'll know you've been flying. $24 ($3 manual only).

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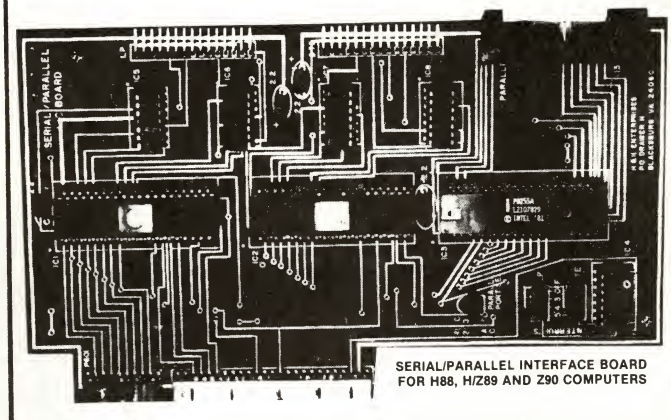

SERIAL/PARALLEL INTERFACE BOARD FOR H88, H/Z89 AND Z90 COMPUTERS

Here is the interface board that your 2 or 4 MHz H/Z 88/89/90 has been waiting for. Replacing the H88-3 serial board, KC1222 gives you the standard serial ports PLUS three bi-directional user-programmable parallel ports. These parallel ports may be used not only for lower cost parallel printers, but also real time clocks, home security/control, UVPROM programmers, etc. By combining serial and parallel I/O capabilities on a single card, only one bus slot is used - a very important consideration for future system expansion. Kit KC1222 has all items necessary for two serial and three parallel ports, including all cables and hardware. Kit KP1222 has the same items less serial chips, cables and hardware.

PRINTER DRIVERS. The Epson MX-80, – 100, C. Itoh 8510, NEC 8023A and Okidata Microline series are presently supported under HDOS and Heath's CP/M. The Smith Corona TP-1 and others are being added. Source code is included on 5¼" hard sectored disk.

PRINTER PACKAGES. We are offering a package deal with the C. Itoh and NEC printers. Both printers feature bi-directional logic seeking print at 120 characters per second, dot graphics, multiple print and character fonts, friction feed and adjustable tractors. The C. Itoh styling matches the '89 styling. We setup the printer and ship it to you checked out - it will work the first time you use it. The package has printer, interconnect cable and software. Gone are the worries about making a cable, setting the proper switches, etc.

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Getting There Faster: Benchmarking Math Chip Versus Compiler

John C. Roos

Processing speed is a major factor in evaluation and application of small computers. While the Heath H11 sixteen-bit machine is one of the faster small computers, its machine speed can be doubled in many applications with the addition of the H11-6 Extended Instruction Set/Floating Instruction Set (EIS/FIS) chip. When compared to using BASIC alone, employing the EIS/FIS chip in combination with FORTRAN reduced the execution time for one of my benchmarks by a factor of fourteen.

In this article, I will describe the H11 system and the tests I performed to evaluate the EIS/FIS chip. Tests were made using BASIC and FORTRAN IV.

The same problems were run using each language with and without the addition of the chip. The results obtained illustrate the relative improvements to be expected from FORTRAN as compared to BASIC, with and without the hardware math instructions, for several types of programs.

I should also add that the usefulness of these results is not limited to the H11 owner. Products similar to the H11-6 chip are available for the H8 and H/Z89 machines. Users of this equipment can expect processing improvements similar to those obtained for the H11 if they go to FORTRAN or add a hardware math instruction set to their machines.

The H11 computer system

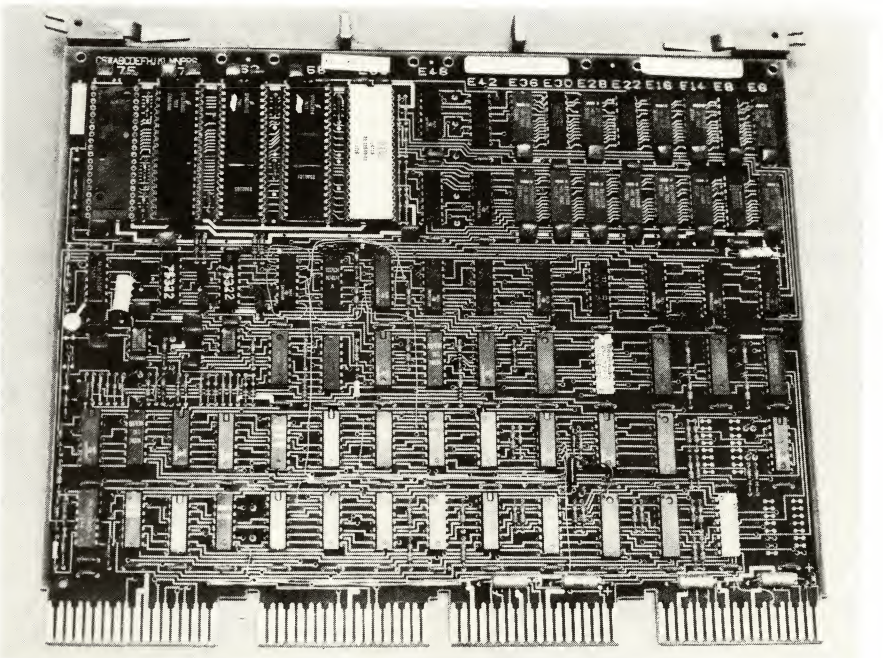
As offered by Heath, the H11 system is composed of two major boxes and the terminal. One box is the central processor unit (CPU) and the other is the H27 floppy disk unit. The entire design is based upon the Digital Equipment Corporation (DEC) PDP 11-03 computer and uses the same LSI-11 CPU card and essentially the same DEC software. DEC supplies the LSI-11 and software, while Heath has designed the rest of the system. Most of the features of the DEC PDP-11V03 computer system are retained.

The H11 CPU box contains the LSI-11 processor card, one or more memory cards, and parallel and serial interfaces to support the terminal, printer, paper tape, or other peripherals. Eight backplane positions are provided for circuit cards. These are sufficient because all addressable memory may be located on a single card. The LSI-11 can address 32 kilowords of 16-bit memory or 64 kilobytes. On the PDP-11 computers, the upper 4K (words) of address space is reserved for input/output (I/O), so only 56K (bytes) of RAM can actually be addressed. Normally, this is not a limitation because the disk-based software supports a number of virtual memory expansion techniques.

Two eight-inch drives are used in the H27 floppy disk unit. These are single-density drives which utilize only one side of the disk. Each drive has a capacity of 256 kilobytes. Memorex builds the drives. The controller board and backplane interface card are preassembled by Heath, so assembly of the H27 is a weekend task at most.

Heath Company offers two main software packages for the H11/H27 system: the HT-11 operating system and FORTRAN IV. HT-11 is the disk operating system and includes an editor, an assembler, numerous utilities, and a capable BASIC interpreter. It is an early version of the DEC RT-11 software system. A comparison of manuals indicates that almost all RT-11 features are supported.

For an additional charge, FORTRAN IV may be obtained. This is the American National Standard FORTRAN X3.9-1966 version and has a number of useful extensions. FORTRAN is very effective for doing math. Some tasks are more easily programmed in FORTRAN than in BASIC because of an extensive library of preprogrammed functions. Additionally, FORTRAN runs much faster than BASIC. BASIC interprets each command every



The DEC LSI-11 CPU is the heart of the H11 16-bit computer. This is an early CPU with 4K of memory resident on the card. In the new H11A computer, a half-size card is used and all memory is located on an additional card. In either case, the H11-6 hardware processor is installed in the vacant socket at upper left.

time it's executed, so it has to figure out the machine language each time a command appears. FORTRAN compiles the program once and doesn't have to worry about converting it to machine language thereafter. The resulting speed difference was quite apparent from the tests I made to evaluate the EIS/FIS chip.

The extended instruction arithmetic chip

The design of the LSI-11 is well thought out. In the standard H11, the hardware math instruction chip is not installed on the LSI-11 CPU card. Many applications do not warrant the added expense. This is especially so if the CPU time is largely spent in operator interaction or doing I/O. For the more speed-conscious users, the benefits of hardware math may be obtained just by plugging the IC into a socket provided on the CPU card. All operations in BASIC and FORTRAN remain the same and are transparent to the user. The only apparent result is a speed increase. No change to existing BASIC or FORTRAN source programs is required. Previously assembled programs will run without alteration at their previous speed. To obtain any speed increase, however, programs written in assembly language must be recoded to utilize the new instructions provided by the chip.

DEC refers to this chip as the "Extended Arithmetic Option." Actually it does more than provide floating-point math. Adding the chip increases the number of microcoded instructions in the CPU machine language instruction set. Thus it is not a coprocessor or separate CPU to which floating-point problems are routed for execution. Instead, it simply increases the number of instructions in the LSI-11 repertoire.

The LSI-11 and most of the larger PDP-11s do not have a multiplication or division instruction as part of the basic instruction set. Math operations are limited to integer addition and subtraction. There are no floating-point instructions at all.

The EIS/FIS instruction set chip adds the necessary microcode to provide multiply (MUL) and divide (DIV) instructions for integer math. In addition, the floating-point instructions, FADD, FSUB, FMUL, and FDIV are provided. These are of direct benefit to the assembly language programmer because single instructions replace complex routines which would otherwise be required. Programs in high-level languages such as BASIC and FORTRAN run faster only if the interpreter or compiler makes use of the added instructions. The program itself does not use them.

As a consequence, the source code for a BASIC or FORTRAN program is unchanged. What must be changed to utilize the added machine instructions is the BASIC or FORTRAN language itself. This is done by using a different version of BASIC and a different version of the FORTRAN library. Both are provided as part of the HT-11 and HT-11 FORTRAN software packages supplied by Heath.

Installation

Installation of the EIS/FIS chip is easy. The H11-6 chip is packed in conductive foam in a very nice little box, sort of like a diamond! Heath and DEC provide an extensive set of installation instructions. Each step of the procedure is detailed in photographs. The chip is a metal oxide semiconductor (MOS) device and damage from static electricity is a real possibility. The intent of the instructions is to ensure that the IC survives the trip from box to socket unharmed.

After the CPU card is removed from the mainframe, the card is positioned on the bench. The chip and its foam packing are removed as a unit from the box and the foam is brought into electrical contact with the CPU card. Removal of the IC from the foam is done while the foam is held tightly to the card. This assures that everything is at the same potential; CPU, foam, IC, and you!

The IC pins are inserted into the vacant socket on the CPU card. After a check to ensure that all pins are properly started, the chip is carefully pushed into the socket. One hand is always kept in contact with the board during this process to prevent accumulated static on the body from breaking something.

Upon completion of the IC installation, the CPU is returned to the computer chassis and testing can commence. Before testing the computer with the new software, you should ensure that everything works as before. Installation of the chip should have absolutely no effect on the operation of the computer with the old (non-EIS/FIS) software. HT-11, BASIC, FORTRAN, and the utilities should all run as before and at the same speed.

Operation

To understand the operating procedures for using the hardware math chip, it is necessary to discuss the HT-11 file name conventions. The file name has two parts: a six-character (maximum) name, and an extension having up to three characters. The extension is used to indicate the purpose of the file. Several are standard: .BAS indicates a BASIC program; .DAT indicates a data file; .SAV indicates a saved file in memory image; and so on. A default convention makes it unnecessary for the user to type the extension under most circumstances. Thus to run BASIC, the command R BASIC is identical to R BASIC.SAV. In this case, the extension SAV is assumed if not given.

For BASIC, there are three interpreter files provided on the HT-11 system disk. BASIC.SAV is the "normal" BASIC which does not utilize or require the EIS/FIS chip. XBASIC.SAV has extensions for commercial applications such as formatted output and string arithmetic to give extended precision. It does not utilize the hardware math chip either. BASIC.FIS re-

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lies on the hardware math chip; as a consequence, the interpreter is about 1,000 bytes smaller than BASIC.SAV.

Operation is simplicity itself. Normal BASIC is obtained by typing R BASIC or R BASIC.SAV. This interpreter is loaded and runs normally even if the EIS/FIS chip is present. To use the interpreter for the EIS/FIS chip one simply types R BASIC.FIS and the proper interpreter loads. For either interpreter, the BASIC language is the same so all existing software runs with no changes.

For FORTRAN, the procedure is different but equally straightforward. HT-11 FORTRAN is a two-pass compiler/linker system. A source program is prepared using the editor. This is processed by the FORTRAN compiler to produce an intermediate object file. To this file must be added preprogrammed functions from the FORTRAN system library file before the package can be run. The preprogrammed system library functions include math functions such as SIN, ALOG, ARCTANGENT, and utilities such as RAN, which creates random numbers. The object file is scanned by the linker and the required modules are copied from the library file and linked to the object file to produce the final run package.

Addition of the hardware math chip has no effect upon the compiler. The same one is used. Two FORTRAN libraries are provided, however. As in the case of BASIC, one assumes the chip is present, and the other doesn't care.

FORTRAN requires a one-time creation of a special system disk by combining files from the HT-11 distribution diskette and a FORTRAN distribution diskette. This produces the system disk used in normal FORTRAN operation. On the FORTRAN distribution diskette are two FORTRAN libraries: FORLIB.OBJ and FORLIB.FIS. It is FORLIB.FIS which utilizes the EIS/FIS chip.

The linker expects to use a library named FORLIB.OBJ. In preparing the FORTRAN working disk, the file FORLIB.FIS is simply copied from the distribution diskette to the working diskette and the file name is changed to FORLIB.OBJ in the process. When the linker is run, it accesses the correct file to utilize the EIS/FIS chip.

From this point on, the presence of the hardware math chip is transparent to the operator and all procedures and source code are identical.

The system can be fooled into calling the hardware math version of BASIC in a similar way. A system diskette is prepared in which BASIC.FIS is renamed BASIC.SAV and the command R BASIC will then run the EIS/FIS version.

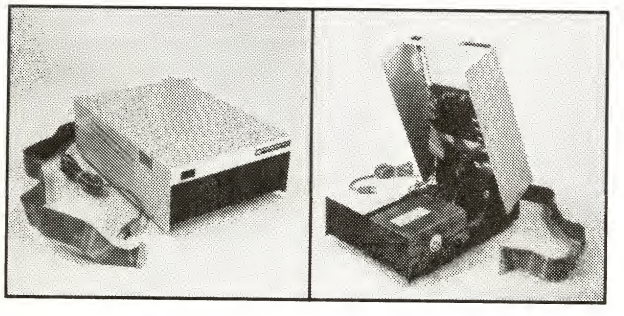
Benchmarks

Benchmarks should be carefully chosen to reveal the information sought for the test. In this case, I had two objectives. One objective was to find out how much faster a program consisting entirely of math operations would run — both with the EIS/FIS chip and as a function of programming language (BASIC or FORTRAN). For a given language, a benchmark chosen with this objective in mind would show the maximum speed increase, though the program itself might not necessarily be practical.

The second objective was to ascertain the relative benefit of adding the chip compared to reprogramming existing BASIC programs in FORTRAN. In other words, to learn what the effect of the choice of language as well as the EIS/FIS chip would be on practical programs consisting of more than just math operations.

My first benchmark program provided a "math only" problem. Calculation of the trigonometric tangent function by the identity TAN(x)=SIN(x)/COS(x) is a lengthy procedure consisting almost entirely of math operations. The benchmark program, TANF, was written in both BASIC and FORTRAN. It consisted of an inner loop in which the tangent of each angle from 1 to 1,000 radians was computed. An outer loop permitted the number of inner loops executed to be set so that conveniently long running times were obtained for ease of timing. In the FORTRAN version, integer math was avoided to preserve the parallel with BASIC, which uses only floating-point. The DO statement was not used to increment the loops. Rather, the loops were incremented with floating-point addition and logical IF statements were used to exit each loop.

My second benchmark used an existing program for which versions in both



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BASIC and FORTRAN existed. Its long running time in BASIC had inspired creation of a version in FORTRAN. This program, called NLOK, is a typical engineering number cruncher. By a process of trial and error it searches for a solution which cannot be found by using a simple formula. It uses floating-point math, integer math, bubble sorts, and moves data to and from array storage. It does no I/O until a solution is found. It was exactly the type of program which I expected to benefit as much from using FORTRAN as from speeding up the math operations with the EIS/FIS chip.

To confirm the results obtained for the NLOK runs, I also tried a program in BASIC called HITAP. HITAP is used to analyze radio frequency and microwave circuit designs. In this problem, the various components are modelled by matrices of four complex variables. These matrices must be added, subtracted, multiplied, and divided, to yield the overall network response. Since BASIC does not support these operations directly, extensive use of conversions from rectangular to polar coordinates and the converse is required. These operations require floating-point math and exercise all of the trig functions in BASIC.

PROGRAMS:	TANF	NLOK	HITAP
A. Execution Times			
Execution Methods			
FORTRAN—FIS CHIP	6.2	160	—
FORTRAN	28	310	—
BASIC—FIS CHIP	10	1980	85
BASIC	37	2280	135
B. Effect of EIS/FIS Chip in Terms of Execution Time			
Speedup Factors (FORTRAN)	4.5	1.9	—
Speedup Factors (BASIC)	3.75	1.15	1 58
Average Improvement = 2.6 to 1			
C. Effect of Language—FORTRAN speed compared to BASIC			
Speedup Factors (BASIC, with chip, to FORTRAN, no chip)	.38	6.39	—
Speedup Factors (no chip)	1.32	7.35	—
Speedup Factors (with chip)	1.61	12.3	—
Speedup Factors (BASIC, no chip, to FORTRAN with chip)	5.9	14.25	—

Table 1.

Test results

In performing the tests, care was taken to set accurate time measurements. In the case of TANF, using FORTRAN and the EIS/FIS CHIP, the computer required only 6 seconds to compute the one thousand tangents. This is hard to time, so ten complete executions were performed and the time measured was divided by 10. The test results are summarized in Table 1 for each of the three programs.

Part A of the table shows the execution time in seconds normalized to a single execution of the same problem. Part B indicates the relative increase in speed for the BASIC and FORTRAN versions of each program when the EIS/FIS chip is

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used. In part C of the table the effect of choice of language is shown as a speedup factor for FORTRAN relative to BASIC with and without the EIS/FIS chip. The final row of Part C compares BASIC without the chip to FORTRAN with the chip. It is here that the greatest improvement is seen.

The running times for the tangent calculations are shown in the first column of Table 1. (The sole exception to FORTRAN's speed monopoly shows up when BASIC has the advantage of the chip and FORTRAN doesn't; and this only in a program which is artificially math-intensive.) Note that when they're evenly matched with regard to the floating-point processor, BASIC is always slower than FORTRAN —but not as much as one would suspect. I believe that this is because the routines used to compute the SIN and COS at the machine level are probably very similar. Since this is the majority of the program task, the times are similar. BASIC required 37 seconds without the floating-point processor, while FORTRAN required only slightly less time at 28 seconds.

In this instance, hardware floating-point math really helps. The running time for BASIC was reduced from 37 to 10 seconds; a ratio of 3.7 to 1. For FORTRAN the improvement factor was 4.5 to 1; the time dropped from 28 to 6.2 seconds.

In the second column, the results for NLOK are given. Execution time improved from 310 seconds for FORTRAN to 160 seconds when the hardware processor was used. The improvement factor was 1.9 to 1. For BASIC the results were less than spectacular; execution time without the chip in use was a whopping 2280 seconds! This was reduced to 1980 seconds when the floating-point processor was employed. The improvement factor was only 1.15 to one.

HITAP was tested using only BASIC. A matching network for an RF amplifier comprised of about ten components was used as the test problem. The time to compute the performance at twenty frequencies was decreased from 135 to 85 seconds for a 1.6 to 1 increase in execution speed.

For the first test program, TANF, the problem consisted almost entirely of the tangent computation. The similar execution times for both BASIC and FORTRAN indicate that little time is being spent by either language in incrementing the loops or testing the value of the incremented variable. Most of the time is being spent in actually calculating the tangent and the machine speed is the dominant factor. It was in this situation that I expected to see the greatest effect from the hardware floating-point processor, and that turned out to be the case. I suspect that the 4 to 1 speed increase demonstrated is about the most one can expect from the EIS/FIS chip in even the most advantageous situation. The second test illustrates this point.

In the second test, the mix of actual math and data shuffling is about the same. NLOK is full of iterations, conditional branches, and ripple sorts as well as simple four-function math. Here the BASIC interpreter runs much more slowly than FORTRAN. Part C of Table 1 shows that this is true with or without the floating-point processor in use. Conclusion: for this type of problem little time is spent doing math as compared to other operations and the speed increase is more limited—about 2 to 1.

FORTRAN is more efficient and more gains are made by application of the chip to FORTRAN where the time to do math is a much larger proportion of the total time. The chip improved BASIC by only 1.15 to 1, while the improvement for FORTRAN was 1.9 to 1. In this situation, there is more to be gained by programming in FORTRAN than by using the floating-point processor. Without the processor, FORTRAN ran the problem in 310 seconds versus 2280 for BASIC; an improvement of 7.35 to 1. Using the chip with FORTRAN is the best of all cases as compared to BASIC alone. This combination was 14.25 times faster than BASIC without the chip.

Use of the floating-point processor improved HITAP to a much greater extent than was observed for the BASIC version of NLOCK. HITAP is about as complex an engineering task as one would want to attempt in BASIC. HITAP is almost all manipulation of matrices of four complex variables. In doing the matrix math there is considerable conversion from one matrix form to another and continual conversion from rectangular to polar coordinates and back again. This is the reason that the 1.58 to 1 improvement occurs. In a sense, this program probably represents a limiting case for speedup of a BASIC program through use of hardware floating-point math because it does so much of it. Even so, the EIS/FIS chip can only improve that proportion of the total running time which is actually spent doing calculations. All other operations in BASIC will be as slow as ever.

Conclusion

Is the EIS/FIS chip worth the 190 bucks? The answer is very application-dependent. For routine business data processing (particularly in BASIC), the answer would seem to be a definite no. In scientific and engineering work, my data indicates that the improvement in processing time probably will not exceed 2 to 1 even if the program does a lot of math. It is true that more improvement was obtained for the tangent calculations, but that was an impractical program devised to have an unusually high math content.

A more effective way to increase the machine speed is to purchase the FORTRAN system for the H11. The cost is only $250 and much more improvement in processing speed is obtained. For the NLOK program, FORTRAN increased the machine speed by a factor of 7.5, while using the chip with BASIC only improved the speed by a factor of 1.15. Thus FORTRAN is much more cost-effective, and it is not that hard to learn FORTRAN as compared to BASIC. After FORTRAN is up and running, the EIS/FIS instruction chip may still be added to about double the machine speed. The total speed increase for theFORTRAN and math chip combination would be 10 to 20 times.

If, in your situation, the computer is keeping people waiting while it calculates, then FORTRAN is worth the money and so is the EIS/FIS chip. A faster answer is a less expensive answer, and since the total cost for FORTRAN plus the floating-point processor is less than ten percent of the cost of the H11/H27 system and its peripherals, both are good buys.

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Venturing Beyond the Heath/Zenith Disk Controller

James A. Pilarski

Like a lot of other people, I bought my Heath H89 because it was the lowest priced computer that offered a 24-line by 80-column screen and standard (org 0) CP/M. I wanted the full-size screen because that is what I use at work, and I just couldn't get used to the 16 x 64 TRS-80 screen, or the 16 x 40 Apple screen, no matter how hard I tried (and I really did try!). I wanted CP/M because a number of my friends use it, and they constantly bragged about the "huge" public-domain and commercial CP/M software base. I also wanted readily available service when (if?) my computer broke down. The fact that there are two Heathkit Electronic Centers within 35 miles of my house somehow made my decision a little easier.

The problem

After the novelty of owning my own computer had worn off, I gradually became aware that CP/M with a single 95-kilobyte 5-inch drive was not exactly the hot setup. Yes, Heath provided a virtual disk CP/M, so that if you ask for a drive that isn't there it will prompt you to swap the disks at the appropriate time. Nonetheless it was very difficult to do anything that normally required two drives — like disk backups — or required more storage on a single drive — like compiling C programs.

There were very few companies that provided software on Heath format disks; and many of those that did, did so intermittently. Most of the time, I had to collect software through a modem connecting me to the numerous remote bulletin board systems in the area. The promised flood of CP/M software was reaching me only as a trickle.

Obviously, I needed an 8-inch disk subsystem. This would give me CP/M media compatibility, a second drive to transfer files to, and a lot more storage. About this time, Heath began to market their solution to my problem. For $3,795, I could have bought an 8-inch disk drive controller, two 8-inch double-density double-sided disk drives with a power supply, and a color-matched cabinet with the Heath logo. I am sure that somebody thought that this was a good value (otherwise they wouldn't have tried to sell it), but compared to equivalent subsystems for other computers, I felt it was just too expensive.

Heath also developed a double-density 5-inch subsystem ($1,300), and a 10-megabyte hard-disk subsystem ($5,800), each with its own disk controller. Heath seemed determined to charge what I felt were premium prices for their disk subsystems. In addition, Heath would have forced me to use up one of the three precious expansion slots in order to use any of the new controllers. And to top it off, Heath CP/M would support only two of the four available controllers at any one time.

At first, everybody seemed to think that I was being unreasonable. A number of people were quite willing to retire their hard-sectored disk controller to the parts bin just as soon as they transferred their current software over to the new format. Still others were willing to ignore the 8-inch subsystem altogether, and go with all 5-inch drives.

The promised flood of CP/M software was reaching me only as a trickle.

On the other hand, I felt that Heath's solutions caused more problems than they solved. All the vendors supporting the H89 used the 5-inch hard sectored format to distribute their software, so I wanted that. Without 8-inch drives, I was still going to have to sweat blood in order to get most of the CP/M software, so I wanted that. And I didn't want to lose the option of using the new 5-inch double-density format. No matter what combination of subsystems I selected, I was going to have to sacrifice something.

The solution

Apparently, I wasn't all that unreasonable, because it wasn't long before I started to see a number of products that did more or less what I

wanted. One product that does more for me than any of the others is made by Controlled Data Recording Systems, Inc., or C.D.R..

For $595, C.D.R. provided me with a disk controller that supports: two double-density 8-inch drives and two double-density 5-inch drives; a programmable read-only memory (PROM) chip to load CP/M into memory through their controller; an org-0 PROM chip to switch in the full 64K of read/write random access memory (RAM) before it loads CP/M; a 10-foot ribbon cable that connects to two standard 8-inch disk drives; and CP/M on an 8-inch single-density diskette with the BIOS modified to use drives connected to either their controller or the old hard-sectored Heath controller. (If I wished, I could have gotten a ribbon cable for a 5-inch drive and CP/M on a 5-inch double-density diskette.) This gave me the potential to use up to seven different disk drives for a total of 4.4 megabytes of unformatted disk storage.

Installation of the additional PROM chips and disk controller was very simple, despite the confusing instructions that came with them. The most difficult part was installing an additional PROM socket on the central processor unit (CPU) board. It seems that I have an early H89, and the PROM socket wasn't installed at the factory, so I had to remove the solder from the plated-through holes before I could put the new PROM socket in place.

Although C.D.R. sells a number of different 8-inch and 5-inch disk drives already configured for their controller, I chose to purchase my Shugart drives from another source, mainly because they were cheaper. To their credit, C.D.R. didn't seem to mind a bit, and took the time to explain how to configure the Shugarts for their controller. In fact, whenever I have called, I have always gotten a patient and thorough reply to all of my many questions.

On power-up, the computer beeped twice, just like it always did, and then it showed the familiar "H: " in the upper left corner of the screen. This is the prompt for the standard Heath PROM. It contains a very simple monitor that recognizes just three commands; G(o), S(ubstitute), and B(oot). By typing in "G 10000" (Octal), I transferred control to the C.D.R. PROM boot routine, whose purpose is to load the CP/M routines into memory from the system tracks. Then I typed in "0", and after about 12 nerve-wracking seconds, CP/M finished loading in from drive 0, and the familiar "A>" prompt showed up on the screen. Total installation time, from power-down to power-up, was less than one hour (I work very slowly on my computer).

The features

The C.D.R. PROM provides a number of additional disk diagnostic routines that can be accessed by typing "G 10003" in monitor mode. There are

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Index to Advertisers

Reader Service #		Page #
478	**A. C. T. Marketing** 5¼" Winchester subsystems.	65
447	**ATG Systems, Inc.** ZSPOOL-PLUS adds features to CP/M; ZSD-89 screen dump; EMAIL-89 electronic mail and modem software; Super-19 H/Z19 ROM upgrade.	51
468	**American Computer** Zenith dealer offers Z100, other hardware and software at discount prices.	82
422	**Apogee Software** Robot Battles games for HDOS and CP/M; free games/utilities catalog.	5
431	**Artra, Inc.** Waldo: Housemaster home control system.	37
416	**Buss** Independent newsletter covering Heath/Zenith computers and independent support.	71
418	**C. D. R. Systems, Inc.** Disk controller for H/Z89 supports 8" and 5¼" drives. Hard disk system for the H89, 5 and 10 megabyte.	30 64
481	**Cal-Al Associates** Add-A-Card: plugs fourth right-hand card into H/Z89-90.	64
443	**Cal Med Products** TEAC Slim 5¼" disk drives.	27
433	**Cherry Engineering** Software: communications program, data entry system, multiple key sort,and graphics editor.	13
429	**D-G Electronic Developments Co.** Super H89; HDOS software; H8 hardware includes RAM, Z80 CPU.	2, 46-47
425	**Environmental Control Systems** Perpetual clock/calendar and parallel I/O for H/Z89, H8.	12
409	**Evryware** Fast-action graphic games and interactive fiction.	45
479	**Extended Technology Systems** Enhancements for H/Z terminals and computers.	66
408	**FBE Research Company, Inc.** H/Z89 parallel printer interfaces with software support.	59
436	**Floppy Disk Services** Disk drives, Z100 systems.	69
457	**Generic Software** Software for data base management, financial analysis, education, utilities.	73
402	**Jay Gold, M.D.** Home finance system for HDOS Microsoft BASIC.	73
437	**H & H Enterprises** Serial and parallel interface circuit board. Printer drivers, packages.	61
421	**Hoyle & Hoyle** Data base management system.	16
469	**I. C. R. Futuresoft** CP/M software.	49
472	**Interactive Micro Systems** Software: search utility, games, recipe data base package, Submit utility language.	68
406	**The Keyboard Studio, Inc.** Software and hardware products featuring Z100 series, MPI Z99G Graphics Printer, HDOS modem software interface, Adventure Maker, and Tandon disk drives.	93
458	**Kres Engineering** Heath/Zenith systems support.	29
438	**Leading Edge Products, Inc.** C. Itoh printers.	back cover
419	**Lindley Systems** MX printer driver for CP/M and HDOS; Heath/Zenith graphics for Epson, NEC-8023, C. Itoh; Check Master, Diamond accounting, Mailbag mailing list system.	23
440	**MI-8** 5¼" double-density disk controller.	17
426	**MLM Associates** MORSE 80 communications system, ARCHIVE file organizer; both for HDOS and CP/M.	85
415	**M. P. I.** (Micro Peripherals Inc.) Graphics printers.	91
405	**Magnolia Microsystems** Double density disk controller, 128K H/Z89 RAM, video output, Winchester disks.	63, 66, 83, 85
439	**Patrick McNally** CP/M software for WordStar, graphing, and flight simulation.	61
450	**Media Distributing** Tandon disk drives, Dysan diskettes, 10 MB subsystems.	11
477	**MicroArt Corporation** IMAGE: word processing software with graphics capabilities.	31
461	**Micromaster** Z89 with Winchester disk.	15
465	**MicroWorld Publishing** Typesetting from disk or modem.	54
405	**Magnolia Microsystems** Double density disk controller, 128K H/Z89 RAM, video output, Winchester disks.	63, 66, 83, 85
473	**Najay Systems** 2+4 4MHz speed module for H/Z89.	63
413	**Newline Software** Software including editors, graphics generator, games, device drivers, and resistive network design.	33
	New Orleans General Data Services, Inc.	
448	Pascal MT+ for HDOS.	20
483	H/Z89 board with color graphics, sound effects, and voice synthesis.	72
474	**Next Systems** Z100 software, custom packages.	63
420	**The PC&J Graphics Co.** Nylon ribbons for H14. Programming aids.	54
475	**Payload Computer Services** Zenith dealer featuring Z100 series, Tandon disk drives, C. Itoh printers, CP/M software, Magnolia Microsystems products.	55
476	**Polybytes** Lucidata Pascal, P-code translator, HA-8-3/HA-89-3 support package for HDOS and CP/M.	58
441	**RP Enterprises** Add-in module allowing automatic repeat of any key.	26
455	**Reichert Digital Systems** Software for accounting, financial management, data plotting, permuted indexing, flight planning, logic circuit analysis, mailing list.	21
467	**S-A Design Books** *How to Use: Zenith/Heath Computers,* book by Hal Glatzer.	25
452	**Secured Computer Systems** 16K memory expansion card, H/Z89 serial and parallel I/O.	39
*	**Sextant** Magazine for users of computers from Zenith Radio Corporation.	22
428	**SigmaSoft and Systems** Epson printer driver, emulates H19/H89 screen displays.	58
453	**SoftShop** Software including HDOS modification, device drivers, BASIC and figForth modifications, foreign language games, text editor, and more.	34
445	**The Software Subscription** BASIC cross referencer, Circular Satellite Orbit Calculator, Visual Editor, text processor, remote computer communications, extended RATFOR, games.	36
411	**Software Support** Disk drives.	56
403	**The Software Toolworks** 23 programs including text processing, language utilities, and games.	59
454	**Software Wizardry, Inc.** Software including HDOS Toolkit utilities package, EDBS data base file, CRASH recovery utility, ZLYNK modem utility, and MDS print or file spooler.	53
482	**Spectrum Computer Products** Disk drives.	68
412	**Sunflower Software, Inc.** ZDOS games, Multiuser HDOS, Thermal Systems Analysis Program, CP/M S-BASIC translator.	21
*	**T & E associates, Inc.** HDOS software.	14
470	**Technical Micro Systems, Inc.** 8086 Z80 upgrade board for the H89.	19
*	**Trionyx Electronics, Inc.** Z80 CPU and other support for H8.	6
460	**Ultimate Computer Systems, Inc.** H/Z19, H89 Super89 CPU upgrade package.	32
480	**W. I. S. E.** Serial, parallel, and real time clock for H89.	60
464	**J. C. Williams** 16K RAM expansion for H/Z89.	85
442	**Zeducomp** Full screen text editor.	28

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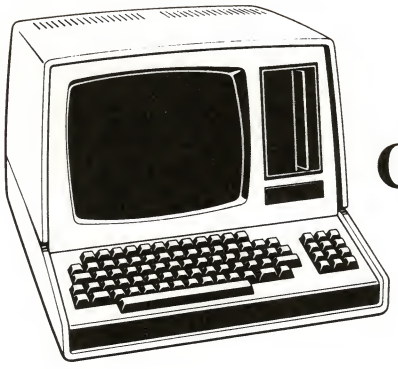
1. Frederick Zimmerman, **HUGCON 1**
2. Hal Glatzer, **IMAGE: A Word and Picture Processor**
3. Kenneth A. Patrick, **Eight Spreadsheets Compared: Charting Products to Eliminate Tedious Calculations**
4. Frederick Zimmerman, **T & E associates: "Just Home Folks" Implementing HDOS Utilities**
5. John C. Roos, **Getting There Faster: Benchmarking Math Chip vs. Compiler**
6. James A. Pilarski, **Venturing Beyond the Heath/Zenith Disk Controller**
7. Frederick Zimmerman, **A Survey of Disk Controller Alternatives**
8. Aaron Reynolds, **Interrupt Programming Under HDOS**
9. John Walker, **Coming Attraction: The Heath/Zenith Community Goes to the Faire**



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sequential and random read and write routines, and a unique routine that determines the status and disk type of all drives connected to the C.D.R. controller.

The best part about this system is that I still have an unaltered Heath computer, because the C.D.R. PROM doesn't replace, but supplements, the Heath PROM. I can load Heath CP/M from any drive connected to the Heath controller, which doesn't recognize the C.D.R. controller or anything attached to it. Or I can load C.D.R. CP/M from any drive connected to the C.D.R. controller using any disk of any density.

If I no longer had a need for the Heath hard-sectored controller, I could connect my original 5-inch drive to the C.D.R. controller. A special circuit on the controller ignores the sector holes on a hard-sectored disk, so I could change all my otherwise useless 95K single-density hard-sectored disks to 160K double-density soft-sectored format. At $3 per disk, the savings can be significant for someone like me who has a large collection of hard-sectored disks.

The C.D.R. BIOS assigns logical disk drives A to D to devices connected to the C.D.R. controller, with drive A assigned to the boot drive, and B, C, and D assigned to the succeeding physical drives in sequence. Since the controller can boot from any drive connected to it, I found this system a little confusing until I became used to it. Any disk drives connected to the Heath controller are unconditionally assigned to logical drives E, F, and G.

The C.D.R. CP/M distribution disk contains a number of utilities which perform most of the functions of equivalent Heath CP/M utilities. Three versions of PUTCPM write the CP/M routines onto the system tracks (instead of SYSGEN and MOVCPM), and I/OMOD modifies the BIOS (instead of CONFIGUR). It also contains a slow but versatile FORMAT program that writes a number of different formats on 8-inch and 5-inch drives, some of which are compatible with Heath formats, and a separate HSFORMAT program that formats standard Heath hard-sectored diskettes using the Heath controller. There is no DUP equivalent to duplicate the entire disk in the C.D.R. package, and the public domain COPYFAST doesn't work with it at this time. Other public-domain programs like DU, SD, and SWEEP work just fine, as well as the standard CP/M utilities like STAT and PIP, and all Heath CP/M software like MBASIC, MAC, SuperCalc, and WordStar.

Other problems

Although I am very pleased with the operation of the C.D.R. subsystem, it has its own little flaws that keep it from being as good as it could be. One

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big drawback is that the BIOS doesn't support virtual drives, which is the one thing I really miss from the Heath CP/M.

The C.D.R. BIOS is supposed to detect the density of any disk on any drive, and automatically reset itself during a warm boot, and most of the time it does, but the system will hang up if the density of the disk in drive A is changed. It will also hang up if a program or the user requests a logical drive which has no physical device assigned to it. The only way to recover from these situations is to press <SHIFT RESET> and cold boot CP/M.

A number of my friends have described my system as "slow," but that is a relative term, and the truth of that statement depends on what they are comparing it against. Compared against a system with a 4- or 6-MHz clock rate and direct memory access (DMA) disk controllers, I would have to agree. Using the C.D.R. controller and standard Shugart 801 disk drives, the H89 will cold boot in 12 seconds, warm boot in 3 seconds, and load Microsoft BASIC 5.2 in 5 seconds. Compared against a standard H89 with just the 5-inch drive, I think it works just fine.

C.D.R., though, gets all the blame for the length of time it takes to format a disk. Regardless of density, an 8-inch disk will spin for nearly five minutes before the format program is finished with it, not counting the time it takes to set the format parameters. C.D.R. has said that the reason formatting takes so long is because it is verifying the disk at the same time. This may be true, but when I have ten brand new disks that I want to format and SYSGEN, I would rather take my chances on a bad disk.

Conclusion

The C.D.R. disk controller with CP/M has given me the answer to almost all my disk storage problems. I have CP/M and Heath media compatibility, more disk storage capacity than I will need for some time, and additional drives to conveniently copy files to, at a cost substantially less than that of comparable Heath equipment. The few problems that it does have do not prevent me from doing what I need to do.

P.S. As of this writing, C.D.R. is advertising the same controller and CP/M for $495 instead of the $595 I paid, which makes it an even better buy.

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A Survey of Disk Controller Alternatives

Frederick Zimmerman

Company and Product	Price	Ordering information	Date of initial shipment	With which Heath/Zenith computing products is your controller compatible?	Can your controller use soft-sectored disks?	Can your controller use hard-sectored disks?
Livingston Logic Labs *FDC-Z8 and FDC-89*	$199 for FDC-Z8 with HDOS & CP/M drivers; $179 for FDC-89 with HDOS & CP/M drivers	P.O. Box 5334, Pasadena, CA 91107 Phone: 213/792-4763, 5 PM to 8 PM, Pacific Time; check or money order	June 1981	H8 with Z-80 CPU; H/Z89, Z/90 with 0-Org capability	yes	no
Magnolia Microsystems *Double Density Disk Controller*	$595, including cables & CP/M	2264 Fifteenth Ave. West, Seattle, WA 98119 Phone: 800/426-2841 or 206/285-7266	May 1981	H88; H/Z89; Z90	yes	no; but may be used simultaneously with H17 10-sector controller for single-density 10 sector 5¼-inch Heath format
C.D.R. Systems, Inc. *FDC-H8 & FCD-880H*	$495 for FDC-H8; $495 for FDC-880H	7210 Clairemont Mesa Blvd., San Diego, CA 92111 Phone: 714/560-1272 Check, money order, Visa, MasterCard, or C.O.D., along with your CP/M serial number; or see your local Zenith dealer	FDC-880H: December 1979 FDC-H8: December 1982	FDC-H8: H8 FDC-880H: H/Z89, Z90	yes	yes; 10-sector 5¼-inch hard-sectored media. The hard-sectored disk is treated as a soft-sectored disk type (ignores sector holes).
Trionyx Electronics, Inc. *C-H8 Floppy Disk Controller*	$450 kit; $550 assembled	P.O. Box 5131, Santa Ana, CA 92704 Phone: 714/830-2092 Visa, MasterCard, prepaid check	December 1982 (scheduled)	all Heath H8 products; will probably repackage this controller for the H89 at a later date	yes	yes; 10-sector 5¼-inch disks.
Mako Data Products *MH8-37*	$380 + $5 for shipping	1441-B North Red Gum, Anaheim, CA 92806 Phone: 714/632-8583 C.O.D. okay, no credit cards		H8 with H17 or H37 drives	yes	no
MI-8 *The Doubler*	$249.95	822 East County Road 30, Ft. Collins, CO 80525 Phone: 303/669-4416 checks, Visa, MasterCard, no C.O.D.	October 1982	H8; H/Z89	yes	yes

Sextant recently sent questionnaires to six companies which produce disk controllers for the H8 and H/Z89. We've summarized the answers we received in the following series of charts. The information in the charts follows the suppliers' wording as closely as possible. The columns are organized in the order we received the information from the suppliers.

(Initially we planned to include Percom Data Company's ZFD Controller in our survey, but Percom stopped selling the ZFD Controller as of July 9, 1982, citing support problems and poor sales.)

Single-sided disks?	Double-sided disks?	Can your controller use single-density disks?	Can your controller use double-density disks?	How many disks can your controller support simultaneously?
yes; 8-inch	yes; 8-inch	yes	no	4; any mix of single- and double-sided
yes	yes	yes; single-density 8-inch is supported and is used for general media interchangeability with the rest of the micro-computer world	yes	8; four 8-inch (any mix of formats, single- and double-sided, single- and double-density), four 5¼-inch (any mix of formats, 40 and 80 track, single- and double-sided, single- and double-density). Works in any of three right-hand slots and may be used simultaneously with other controllers if desired.
yes	yes	yes; IBM 3740 single-density, and either Cromemco single-density format or H/Z37 single-density format for 5¼-inch disks	yes	FDC-H8: 4; the CP/M BIOS is currently set up for up to 4 soft-sectored drives through the FDC-H8 and 3 hard-sectored drives through the Heath/Zenith hard-sectored controller. Both controllers can be connected to the same set of 5¼-inch drives. The hardware is set for four 5¼-inch and four 8-inch drives. FDC-880H: 4; the BIOS software is currently set up for up to 4 soft-sectored drives through the FDC-880H and 3 hard-sectored drives through the Heath/Zenith hard-sectored controller. Both controllers can be used with the same set of 5¼-inch drives using the Deano Electronics Dual Board Adapter priced at $29.00.
yes	yes	yes; soft-sectored and 10-sector 5¼-inch hard-sectored formats.	yes; soft-sectored only	11; four 5¼-inch, four 8-inch, three Xebec Winchester
yes	yes	yes	yes; and extended density, IBM format	4; multi-mode capacity, mix 5¼-inch and 8-inch drives. Mix hard- and soft-sectored drives by keeping H17 or other controller on-line.
yes	yes	yes	yes	The Doubler may support up to 8 double-sided or 16 single-sided drives.

Company & Product	Total storage capacity in Kilobytes (KB) and Megabytes (MB)	Tracks per side	Sectors per track
Livingston Logic Labs *FDC-Z8 & FDC-89*	maximum capacity per disk: 500 KB maximum total capacity: (four drives) 2 MB	industry-standard 77 tracks per side	26 sectors per track
Magnolia Microsystems *Double Density Disk Controller*	5¼-inch varies according to formats supported: Z37 single-density, Z37 double-density, MMS double-density, Z37 extended density, respectively. single-sided 48 tpi: 90, 140, 162, 182 KB double-sided 48 tpi: 184, 304, 342, 382 KB single-sided 96 tpi: 190, 308, 340, 386 KB double-sided 96 tpi: 388, 624, 700, 782 KB 8-inch also varies according to formats supported: IBM single-density, MMS double-density, MMS REMEX, Z47 single-density, Z47 double-density, Z47 extended density, Z67 double-density, respectively. single-sided: 241, 594, 594, 241, 482, 596, 482 KB double-sided: n.a., 1210, 1210, 490, 980, 1208, 980 KB	5¼-inch: 40 or 80 tracks per side 8-inch: industry-standard 77 tracks per side	5¼-inch: soft-sectored single- and double-sided 48 and 96 tpi Z37 single-density 10, Z37 double-density 16, MMS double-density 9, Z37 extended density 5; 8-inch: IBM single-density 26, MMS double-density 16, MMS REMEX 8, Z47 single-density 26, Z47 double-density 26, Z47 extended density 8, Z67 double-density 26
C. D. R. Systems, Inc. *FDC-H8 & FDC-880H*	5¼-inch varies according to formats supported: single-density, double-density, and extended density, respectively. single-sided 40-track: 92, 182, 204 KB double-sided 40-track: 184, 366, 429 KB 8-inch also varies according to formats supported: single-density, double-density, and extended density, respectively. single-sided: 256, 509, 627 KB double-sided: 512 KB, 1.02 MB, 1.25 MB	5¼-inch: 40 or 80 tracks per side 8-inch: 77 tracks per side	5¼-inch: standard single-density 18, double-density 18, extended single-density 10, extended double-density 10; alternate single-density 16, double-density 16, extended single-density 5, extended double-density 5; 8-inch: single-density 26, double-density 26, extended single-density 15, extended double-density 8
Trionyx Electronics, Inc. *C-H8 Floppy Disk Controller*	5¼-inch: hard-sectored single-density 400 KB, double-density 800 KB, unformatted; soft-sectored double-density 654 KB, extended density 819 KB, unformatted 8-inch: 1.025 MB per drive in double-density format, 1.26 MB per drive in Heath extended format Winchester: up to two of 5 or 10 MB each maximum total storage capacity with currently available hardware: 26.7 MB	5¼-inch: The controller will function with drives with either 40 or 80 tracks per side. 8-inch: The controller will handle the industry-standard 77 tracks per side. Winchester technology: The SASI bus interface will support up to 8 Winchester heads with 1024 tracks per head.	5¼-inch: The controller can handle any number of sectors per track up to 18 including the Heath formats of 16, 5, and 10 (for soft-sectored disks) or 10 (for hard-sectored disks). The controller can also be configured to read/write other 5¼-inch formats (such as Atari, Apple, TRS-80, etc.) but these formats will not be supported by Trionyx. 8-inch: The controller will handle the industry-standard single-density 26 sectors per track and double-density 52 sectors per track as well as the Heath extended density 64 sectors per track. Winchester technology: The SASI bus interface will support up to 32 sectors per track.
Mako Data Products *MH8-37*	single-density single-sided: 92 KB double-density single-sided: 152 KB extended double-density single-sided: 190 KB double-density double-sided: 632 KB extended double-density double-sided: 790 KB extended double-density using Tandon DDD drives: 790 KB drive capacity	formatted single-density single-sided: 40 formatted double-density single-sided: 40 extended double-density single-sided: 40 double-density double-sided drives: 80 extended double-density double-sided: 80	formatted single-density using H17 type drives: 20 sectors/track formatted double-density using H17 type drives: 32 sectors/track extended double-density using H17 type drives: 40 sectors/track double-density using Tandon DDD drives: 32 sectors/track extended double-density using Tandon DDD drives: 40 sectors/track
MI-8 *The Doubler*	double-density soft-sectored: 184 KB double-sided 80-track soft-sectored: 737 KB	double-density soft-sectored double-sided: 80 tracks per side (Hard-sectored disks may still be used. The holes are merely ignored.)	selectable, supports either Heath or Magnolia formats of 16 and 9 sectors per track

Bytes/sector	Compatible with HDOS?	Compatible with CP/M?	Documentation	Suppliers' Comments
128	yes; HDOS 2.0	yes; CP/M 2.2.03	The hardware documentation consists of instructions for installation, complete with diagrams where needed, as well as a schematic. The software documentation consists of setup and installation instructions, as well as usage instructions for each product.	Modified boot/monitor ROMs to allow booting from any drive connected to the FDC-Z8 or FDC-89. All FDC-Z8 and FDC-89 software provides automatic detection of single- and double-sided drives so drives need not be SET as single- or double-sided.
5¼-inch: Z37 single-density 256, Z37 double-density 256, MMS double-density 512, Z37 extended density 1024 8-inch: IBM single-density 128, MMS double-density 512, MMS REMEX 1024, Z47 single-density 128, Z47 double-density 256, Z47 extended density 1024, Z67 double-density 256	HDOS support is available from Ultimeth Corp.	yes; CP/M 2.24	Hardware installation manual (pictorial); monitor EPROM documentation (compatibility chart and installation); CP/M 2.24 operating system user guide, plus standard Digital Research manual set.	Cables for both 5¼-inch and 8-inch drives; new I/O decoder and Monitor PROMs; independent buffering of drive cables; two-level digitally timed write pre-compensation; clock switching designed for errorless transition between 5¼-inch and 8-inch disk standards; CP/M 2.24 in bootable form.
5¼-inch: standard single-density 128, double-density 256, extended double-density 512; alternate single-density 128, double-density 256, extended double-density 1024; 8-inch: single-density 128, double-density 256, extended double-density 1024	yes; HDOS driver developed by Livingston Logic Labs is available for $40	yes; CP/M 2.2	The FDC-880H comes with both a hardware and a software manual. The hardware manual uses both schematics and installation drawings. The software manual includes instructions for trial boot, and utility program operation, with a source listing of the BIOS.	One 10-foot interconnect cable supplied; 0-Org conversion PROM supplied. FDC-H8 and FDC-880H come with bootable disks set with your CP/M serial number including the source for the BIOS, I/O modification, Disk Copy, Format, Directory, and standard CP/M utilities. Boot PROM includes drive diagnostics.
5¼-inch: up to 1024 bytes/sector, including Heath standards of 128, 256, and 512 8-inch: The controller uses the industry standard 128 bytes per sector. Winchester technology: The SASI bus interface will support 256 bytes per sector.	yes; HDOS Device Driver available	yes	Schematics, parts list with part prices, kit assembly instructions, users' guide, software utilities on diskette.	
5¼-inch: single-density single-sided 128; double-density single-sided 128; extended double-density single-sided 128; double-density double-sided 256; extended double-density double-sided 256	yes; requires HDOS 2.0 (using DKH37.DVD)	yes; CP/M 2.2.03	We weren't able to see the documentation before this issue went to press. However, Mako says documentation for the MH8-37 will include installation and operation guides, as well as recalibration instructions and a schematic. Also included will be the application notes and data information about the disk controller chip set.	Bus space for this board is free, since it replaces the 0-origin card. A user status port is provided and may be configured as an 0-Org modification. This board will also run in the auxiliary positions of the Trionyx H90 motherboard.
selectable support of either Heath or MMS formats: 256 or 512	yes	yes	We weren't able to see the documentation before this issue went to press. However, MI-8 says installation will be straightforward.	

Interrupt Programming Under HDOS

Aaron Reynolds

Some programs, like printer spoolers, seem to run "at the same time" as other programs. Have you ever wondered how they work?

Well, they can't actually run at the same time since there is only one processor to go around. The answer is that they do their work at "interrupt time", by processing special hardware-generated signals called interrupts. This article is intended to help you understand how these programs work, and how to write your own.

Consider the following situation. You have a program which reads characters from an input device; and for each character read, a lengthy computation is performed. Also, assume that you have no control over when the characters are going to arrive, and that the input device can only hold one character at a time. One way the program could work is to wait for a character to arrive at the input device (this might be signalled by a certain bit in a memory register associated with the device being set to 1), read the character, then go off to do the computation and return to get the next character when the computation is done. But remember that you have no control over when characters arrive at the input device. It is entirely possible that while your program is performing the computation for the first character, two more characters arrive at the input device. The device can only hold one character at a time so it has two choices. Either it can ignore the incoming character (since the one already there has not been read out), or it can write over the current character with the new one. Either way a character is lost—an undesirable event. How can you write a program that will work without the possibility of losing characters?

It would be nice if there was some way to stop in the middle of the computation when a character arrives at the input device. Go get the character and save it somewhere, and then resume the computation at exactly the point where it left off when the character arrived. This is, in fact, what an interrupt does.

An interrupt is implemented at two levels, hardware and software. At the hardware level, a way is needed for the input device to signal the processor (which is currently running the computation part of your program) that a character has arrived, and that current processing needs to be suspended. At the software level, a program is needed to process the interrupt (in this case, go get the character and save it). Since there may be many devices which can generate an interrupt at the hardware level, each needing a separate processing program, we also need a way to decide which of the devices has interrupted, and therefore which of the processing programs to call. This part of the process can occur at either a hardware or a software level.

There is also this additional problem: since there is (usually!) only one central processing unit (CPU) in the system, and since the program that was running at the time of the interrupt must be restarted at the exact point it was stopped, we must save all of the information about what was going on at the time of the interrupt. The values in all of the CPU registers must be saved, because the interrupt processing routine may use these same registers. And the value of the program counter (PC) must be saved so that the main program can be restarted at the point it left off. There may also be other things that must be saved depending on the particular computer involved. The general rule is that we must save anything that might be altered by the interrupt routine to the detriment of restarting the main program at exactly the same point, in exactly the same environment, as it was when it was interrupted. Then all of the saved values can be restored when the interrupt service routine is finished and it is time to resume the interrupted program.

So here is what happens when there is an interrupt system to help your program. The program gets the first character from the input device and starts the computation on it. If another character comes along while the program is doing the computation, the input device signals the CPU to interrupt the currently running program. All of the information about the current state of the interrupted program is saved. (On the H8 and H/Z89, as well as many other computers, this is actually the responsibility of the interrupt processing routine; more on this later.) Then the interrupt processing routine is called. (On the H8 and H/Z89, the interrupting device itself determines which routine to call; the CPU just does what the device tells it to do.) And the character is saved in a buffer. Next, all of the stored information about the state of the interrupted program is restored. (On the H8 and H/Z89, this is also the responsibility of the interrupt processing routine.) And the computation on the first character resumes. When the computation on the first character is complete, the next character is retrieved from the buffer where the interrupt routine saved it.

But wait! What happens if the program goes to get a character, and there isn't one? And how did it get that first character? Well, the answer is that *all* characters are retrieved from the interrupt buffer. The program looks in the buffer, and if there is a character there, it gets it. If there is no character, then the program loops, checking the buffer: is there a character? No. Look again. No character. Look again. Et cetera. When a character comes into the input device, an interrupt occurs—the program is interrupted while checking the interrupt buffer for a character—and a character is put in the buffer. Now when the interrupted program is resumed, it looks in the buffer and *Ah hah!* there is a character in it: the one just placed there by the interrupt routine. In general, the buffer has room for a number of characters, so they can be queued up in case more than one comes along before any are removed.

You should now have a good idea of what an interrupt is, and how it works. The handler detailed later in this article is a very typical application; but it is not the only area in which interrupts can be useful. Almost any kind of input/output (I/O) device can be operated under an interrupt scheme, both for input and for output.

The output problem is very similar to the one we just looked at. I have a bunch

of characters to be output. Here is the first one; I am going off to do something else now. Interrupt me when you're finished and I'll give you the next one. This is very handy for driving printers: your computer doesn't have to wait for the printer. A character is given to it whenever it's ready. For disk drives, the interrupt is usually for I/O of disk sectors instead of characters.

You may now be saying "Great! How can I write interrupt processors (usually called interrupt handlers) for my HDOS system?" Well, that is the subject of the following sections. Handlers for the Heath Disk Operating System (HDOS) are not all that difficult to write, but there are some pitfalls which I will try to show you how to avoid. If you are not saying "Great!", you might read on anyway. One of the best ways to understand something is to see an example of it, and while the interrupt scheme on the H8 and H/Z89 is not a very sophisticated one, it does address most of the major issues involved in writing interrupt handlers.

Notes and suppositions

In order to understand the examples, you will need at least a basic knowledge of assembly language programming. Assembler for the 8080 microprocessor is preferred. And the Heath ASM assembler is best, as all of the examples are written in Heath ASM. I hope this doesn't scare away too many of you, but there is really no other alternative. Interrupt processing requires that the computer be treated at the machine level—setting registers, manipulating the stack, and poking around in memory. This is what assembly language does best, and there is really no substitute. If interrupt programming is something that you would like to do, and you don't know assembler yet, your time will be much better spent learning assembly language, rather than trying to make some language like BASIC do the work. (*It won't!!!*).

You should be familiar with the terms, *stack* and *subroutine*. By *subroutine*, I mean how the *stack* is manipulated to implement a subroutine call and return. If you are not sure about these terms you should look at Appendix A, "Stacks and Calling Sequences".

The examples in this article are written in Heath ASM. This is the *Heath*

Appendix A
Stacks and Calling Sequences

A stack is a means of storing information without knowing beforehand how much information there is to be stored. The stack "grows" as more storage is needed, and "shrinks" as the stored information is retrieved. You can think of a stack as an "inverse gravity" pile, the first element put on the stack goes on the ceiling, and subsequent elements are put under the preceeding ones. In this way, the stack grows down toward the floor, and the "top" of the stack is actually the bottom (i.e., the element closest to the floor). Putting an element onto the stack is called "PUSHing". When information is retrieved off the stack it is taken from the "top", and the stack is "shrunk" by one element; this is called "POPping".

A stack is a last-in, first-out (LIFO) structure: in other words, if I PUSH an element, the element I get is the *last* one I PUSHed. *Example:* If I PUSH A, then PUSH B, then PUSH C, and then do a POP, I will POP C (since it is on the top of the stack). The next POP (provided no PUSHes intervene!) will POP B. (See Figure 1.)

On the H/Z89 and H8, the stack is in memory, along with your program, and the top of the stack (which is just some address in memory) is pointed to by the stack pointer (SP) register of the 8080. Because we PUSH register pairs (HL, DE, or BC), it's convenient to think of the stack as holding 16-bit values. There is also a special kind of PUSH called PUSH PSW. This instruction pushes the accumulator (A) and the current condition flags. When we POP, we POP register pairs, so "POP H" would POP the 16-bit value off the stack and place it in the HL register. There is also a "POP PSW" instruction which gets back the accumulator and the condition flags. The stack usually starts in high memory and grows down towards your program. (You have control, though: just put the value you want in the SP register.) Be careful! It is possible for the stack to grow down into your program and overwrite it.

One of the main uses of the stack is to implement subroutine calls. When a subroutine is called (with the CALL instruction) the current value of the program counter (PC) needs to be saved so that when the subroutine returns, execution continues with the instruction after the CALL. This "return address" could be saved in a fixed location in memory, but then if the subroutine also executed a CALL, the first return address would be lost, since this second return address would be written in the same place. The thing to do is to PUSH the return address onto the stack; then when it is time to return, the return address can be POPped off into the PC.

This brings up one important point: if your program (or one of its subroutines) PUSHes things onto the stack, it must be sure to POP them off before it returns so that the return address is on the top of the stack. When a "CALL addr" is executed, the current PC is pushed onto the stack, and the value corresponding to addr is loaded into the PC (causing a jump to that address). A RET (or one of its conditional forms) causes a POP into the PC register (causing a jump to the return address).

Remember that a RST instruction is one of the things that happens when an interrupt occurs. This pushes the PC of the interrupted program onto the stack, just as if the program had executed a CALL instruction. When the interrupt handler executes a RET instruction, this "return address" into the interrupted routine is POPped into the PC, and execution resumes. An interrupt causes the current program to "CALL" the interrupt handler.

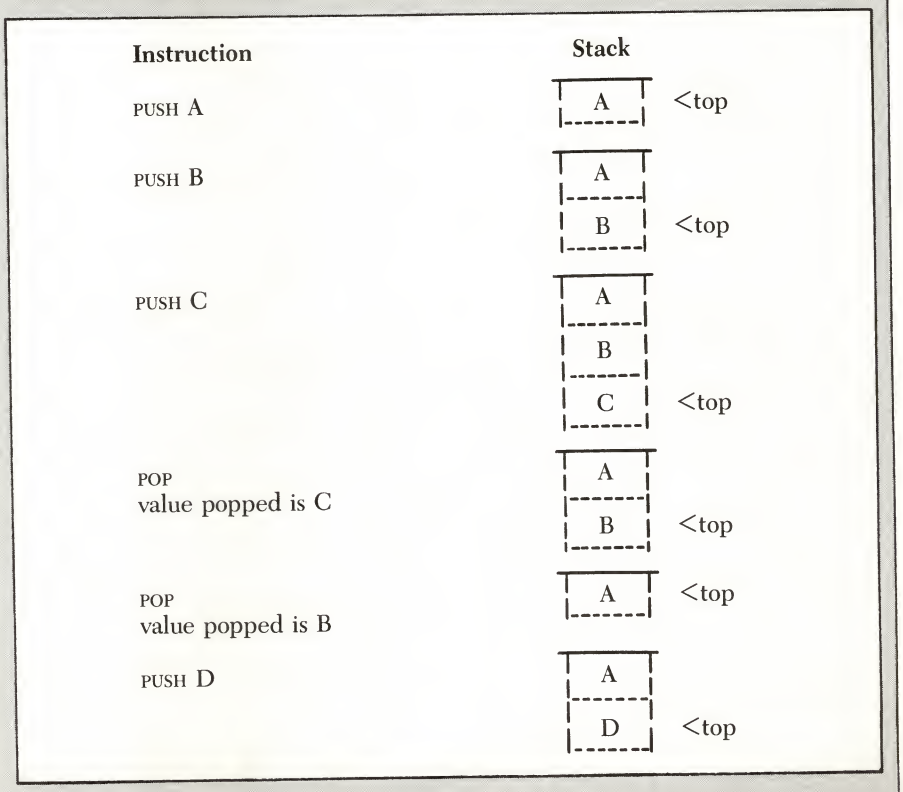

Figure 1: Typical stack operation

Assembly Language supplied with the HDOS operating system. If you don't quite understand a statement in one of the examples, look it up in the "Heath Assembly Language ASM" in the Software Reference Manual supplied with HDOS (Heath manual number 595–2478). Several code fragments are excerpted from the source listing for the MTR–89 H/Z89 monitor, and the PAM–8 H8 Front Panel Monitor. (MTR–89 listing is in Heath manual number 595–2508; PAM–8 in number 595–2348.) The MTR–89 code is copyrighted by the Wintek Corporation, the Heath Company, and by Zenith Data Systems, Inc. The PAM–8 code is copyrighted by the Wintek Corporation. The HDOS operating system, the H8, and the H/Z89 are all products of the Heath Company, Benton Harbor, Michigan 49022.

The 8080 hardware interrupt environment

When a device issues an interrupt to the 8080 microprocessor, what happens is very simple. (The H/Z89 actually has a Z80 in it, but it is operated in 8080-compatible mode. The Z80 has a more general interrupt environment; see Appendix B, "Z80 Interrupt Modes".) The interrupting device changes the logic state on a pin of the 8080 (the INTR pin), which signals the CPU that a device wants interrupt service. At this point, the 8080 completes the execution of the current instruction, disables interrupts (i.e., from now on interrupt requests made by signaling the CPU via the INTR pin will be ignored), and executes the instruction on the data bus. This instruction on the data bus is provided by the interrupting device, so the device actually has to do two things when it wants interrupt service: request the interrupt by signalling the INTR pin of the CPU; and provide the instruction to be executed.

Any instruction can be provided, but it is usually a restart (RST) instruction. The RST instruction does two things: first, it saves the current program counter on the stack; and second, it executes a jump to one of eight locations. Remember that the value of the PC is one of the things we need to save about the state of the interrupted program. Well, the RST instruction does this by PUSHing the PC onto the stack, so we're off to a good start. Each RST instruction includes a three-bit number (0–7), and this argument is multiplied by 10Q (10 octal, i.e., 8 decimal). This means we jump to one of eight places in low memory and start executing the instructions there. The eight possible places are 00Q, 10Q, 20Q, 30Q, 40Q, 50Q, 60Q, and 70Q (remember that the Q means octal: base eight). This means we can have eight different interrupt processing routines, and the devices can select among them by choosing a particular one of the eight possible RST instructions to give to the CPU.

Here is a summary of the interrupt sequence:

Device signals 8080 INTR pin (requests interrupt) and
Device puts RST n (0 <= n <= 7) instruction on data bus.
8080 completes currently executing instruction.
8080 disables *all* interrupts (a Disable Interrupts (DI) instruction is executed).
8080 executes RST n instruction on data bus (PC is not changed).
PC is PUSHed onto the stack.
A JMP (n x 10Q) is executed.

There is one more important thing to note: *all* CPU interrupts have been disabled. Interrupt processing routines usually must deal with transient data, data that won't be around long. Therefore it is important that the interrupt processing routine itself not be interrupted until this volatile data is saved; otherwise the same interrupt, or a different one, may permit the data to be destroyed before it can be saved. Another interrupt may occur during this time, however, in which case it may be missed; so the interrupt processing routine should execute an Enable Interrupts (EI) instruction as soon as possible.

H/Z89, H8 device interrupt selection

The H/Z89 and H8 can handle all eight of the possible RST instructions, but some of them are reserved for special purposes, and on the H/Z89 our selection is somewhat limited by the design of the internal bus. RST 0 is reserved for "Master Reset": this is used to initialize the system and get to the monitor loop. (The monitor loop is responsible for the "H:" that gets everything going; the user cannot process this interrupt.) RST 1 is reserved for the clock interrupt; every 2 milliseconds, the hardware clock issues this interrupt. (HDOS provides an interrupt service routine for the clock, but you can write one of your own. See "The HDOS Device Driver Programmer's Guide" in *REMark* #20. It's an excellent article by Al Dallas, Dale Lamm, and Tom Jorgenson.) RST 2 is reserved for a Single Step interrupt, which is used by debugging programs to set breakpoints. This is an interesting interrupt; it is not generated by the hardware but is rather a "software interrupt" and is generated by a program (or by a key on the H8 front panel).

RST 3, RST 4, RST 5, RST 6, and RST 7 are the main interrupts we will be dealing with. These are the I/O interrupts which are run out to the internal bus on the H8, and they can be generated by the character-oriented I/O devices. The H/Z89 is the same except that only RST 3, RST 4, and RST 5 are run out to the internal bus. (Why Heath didn't run out the others, too, is beyond me.) If you have an HA–88–3 three-port (or two-port) H/Z89 RS–232C serial interface board, you will note that each port has an INTERRUPT jumper. This jumper can be set to OFF, 3, 4, or 5. Well, as you should have guessed by now, this selects either none, RST 3, RST 4, or RST 5 interrupt for the associated port. On the H/Z89, the

Appendix B
Z80 Interrupt Modes

The Z80 central processing unit (CPU) in the H/Z89 (or in the H8 with a Z80 card) has several different modes of interrupt handling. Mode 0 is the 8080A mode, and is downward compatible with the standard 8080 interrupt scheme as described in this article. In addition, two other interrupt modes are provided, one more primitive and one more advanced.

Mode 1 will cause a RST 70Q instruction to be executed for all interrupts. This means that all devices which generate interrupts will call the same handler. This mode is a simplified version of the standard 8080 mode and is intended for applications where it is desirable to have minimal extra hardware to handle interrupts. A system with only one interrupting device could make good use of this mode.

Mode 2 is a much more flexible interrupt handling scheme. In this mode, the special I register of the Z80 CPU is used. When a device interrupts, it places an eight-bit address on the bus. The CPU then forms a 16-bit address by putting the eight bits supplied by the device into the low byte, and the contents of the I register into the high byte. The CPU then goes to the location in memory specified by this address, and fetches two bytes. These two bytes represent the starting address of the interrupt handler; the CPU then executes a CALL to this address. The address in the I register sets the base address of an interrupt routine "table", where the starting addresses of all the interrupt service routines are located. In this mode, there are 255 distinct device interrupts (eight bits worth), as opposed to the eight distinct ones for the standard RST scheme in 8080 mode. This makes it very easy for a device to generate separate interrupts for each function (like input and output). Also, since the high eight bits of the routine fetch address are taken from the I register, we can very easily move the interrupt routine table around in memory. (All we have to do is change the value in the I register.) This mode is very powerful. It is too bad that the H/Z89 (and standard H8) CPU board doesn't support it.

system console is hardwired to the RST 3 interrupt. On the H8–4 four-port serial card for the H8, there is a similar jumper for each port—only there are two additional positions for RST 6 and RST 7. As with the clock interrupt, HDOS provides an interrupt service routine for RST 3 which it expects to be generated by the system console. Note that we could set one (or all) of the serial I/O ports to send RST 3 as well. If this were the case, then our interrupt service routine would first have to decide which device sent the interrupt, since they would all be sending the same one.

On the H/Z89, RST 6 and RST 7 could also be sent, but remember that only RST 3, 4, and 5 are run out to the internal bus. This means that although 6 and 7 are supported, it is not possible for the I/O devices to generate these interrupts. (Those interested in hardware may want to study their H/Z89 schematics and see if jumpering both 3 and 4 will actually cause a RST 7 to be generated.)

```
**      LEVEL 0 - RESET
*       THIS 'INTERRUPT' MAY NOT BE PROCESSED BY A USER PROGRAM.

        ORG     00Q

INIT0   LXI     D,PRSROM
        .
        JMP     INIT
        .

**      LEVEL 1 - CLOCK

INT1    EQU     10Q

        ERRNZ   *-11Q
        CALL    SAVALL          SAVE USER REGISTERS
        MVI     D,0
        JMP     CLOCK           PROCESS CLOCK INTERRUPT
        .

**      LEVEL 2 - SINGLE STEP
*       IF THIS INTERRUPT IS RECEIVED WHEN NOT IN MONITOR MODE,
*       THEN IT IS ASSUMED TO BE GENERATED BY A USER PROGRAM
*       (SINGLE STEPPING OR BREAKPOINTING). IN SUCH CASE, THE
*       USER PROGRAM IS ENTERED THROUGH (UIVEC+3).

INT2    EQU     20Q

        ERRNZ   *-21Q
        CALL    SAVALL          SAVE USER REGISTERS
        LDAX    D
        SET     CTLFLG
        JMP     STPRTN

***     I/O INTERRUPT VECTORS.
*       INTERRUPTS 3 THROUGH 7 ARE AVAILABLE FOR GENERAL I/O USE.
*       THESE INTERRUPTS ARE NOT SUPPORTED BY PAM/8 OR MTR88, AND
*       SHOULD NEVER OCCUR UNLESS THE USER HAS SUPPLIED HANDLER
*       ROUTINES (THROUGH UIVEC)

        ORG     30Q
INT3    JMP     UIVEC+6
        ORG     40Q
INT4    JMP     UIVEC+9
        ORG     50Q
INT5    JMP     UIVEC+12
        ORG     60Q
INT6    JMP     UIVEC+15
        ORG     70Q
INT7    JMP     UIVEC+18
```

Listing 1: The monitor code which processes interrupts

```
CUT1    LDAX    B               (A) = .MFLAG
        ERRNZ   UO.CLK-1        CODE ASSUMED = 01
        RRC
        CC      UIVEC+0         IF SPECIFIED, TRANSFER TO USER

*       RETURN TO PROGRAM FROM INTERRUPT.

INTXIT  POP PSW
        .
        .
        .
        EI
        RET
```

Listing 2: CUT 1

MTR–89 and PAM–8 monitor environment

The monitor program—supplied in read-only memory (ROM)—occupies the low part of memory. Since the interrupts generate jumps to 00Q, 10Q, 20Q, 30Q, 40Q, 50Q, 60Q, and 70Q, which are in low memory, these locations come under the jurisdiction of the monitor code. This means that in order to understand how to process these interrupts, we need to take a careful look at the monitor environment. The monitor code which processes the interrupts is given in Listing 1.

As noted in Listing 1, the level 0 interrupt may not be processed by a user program. This code jumps to INIT, which is the routine which takes care of the bootstrap.

The level 1 interrupt (RST 1) code executes a jump to the CLOCK routine. Note that it first makes a call to the SAVALL routine. The SAVALL routine saves all of the user registers. (Remember that that is one of the things we need to do in order to restart the interrupted routine.) The CLOCK routine eventually calls a routine CUT1, which is of interest to us because it will itself call a user clock routine if there is one. CUT1 is given in Listing 2.

Here is what is going on in CUT1: if the 0th (right most) bit of .MFLAG is set, then the routine at UIVEC+0 is called; this can be the address of a user clock interrupt routine. When this routine returns, the INTXIT code is executed. The INTXIT code puts back all the information saved by SAVALL, turns the interrupts back on, and returns. Where does it return to? Well, remember that when the RST 1 instruction from the interrupting device (the clock) was executed, one of the things it did was PUSH the PC of the interrupted routine onto the stack. When this RET in INTXIT is executed, this value of the PC is POPped off the stack, and put back in the PC. In other words, we return to the exact point in the interrupted routine where we left off, exactly what we want.

So here is what happens when a clock interrupt occurs: the clock interrupts; the current instruction is completed; CPU interrupts are disabled; and a RST 1 instruction is read off the bus and executed. This causes: a) the value of the interrupted routine's PC to be PUSHed onto the stack; and b) a jump to location 10Q. SAVALL is called, which saves all the

information we need to restart the interrupted routine exactly where it was interrupted. Next, we jump to the CLOCK routine, which eventually checks to see if there is a user-supplied clock routine; if so, it is called by calling UIVEC+0. When the UIVEC+0 routine returns, the INTXIT code is executed, which restores all of the restart information saved by SAVALL, turns the CPU interrupts back on, and returns. The value of the PC at the time of the interrupt is restored, and the interrupted program resumes at the point at which it was interrupted.

The level 2 interrupt is very similar to level 1: it also calls SAVALL and then jumps to UIVEC+3. Note, however, that it *jumps* to UIVEC+3 instead of calling it as CUTI does with UIVEC+0. This means that when the routine at UIVEC+3 is ready to return, it needs to execute the code of INTXIT to restore the information saved by SAVALL.

The rest of the interrupts (3–7) merely execute jumps to the UIVEC area. This means that no registers have been saved (since SAVALL wasn't called). If we write a routine to process one of these interrupts, then one of the things that the routine will have to do is save all the registers when it starts, and restore them when it's done.

Now what goes on in this UIVEC area?

Remember that the RST addresses (00Q, 10Q, ...,70Q) are in the monitor ROM area. We want to be able to run our interrupt handler whenever an interrupt of the appropriate type is given; so we want to jump to the beginning of our routine. We could put a JMP instruction at the appropriate low core address. For instance, if we were writing a routine for the level 4 interrupt, we might put a

```
JMP     MYINT
```

instruction at location 40Q, where MYINT was the address of the start of our interrupt handler. But 40Q is in read-only memory; we can't write anything there! So that we can set a jump address for our handler, we jump into a fixed area of the system random access memory (RAM). This fixed RAM address is UIVEC which is at 040.037, and is just beyond the monitor ROM area. You can find what the UIVEC area looks like in Listing 3.

As you can see in the listing, a three-byte area is reserved for each interrupt. That's just enough room for a jump instruction (which takes three bytes: the first byte is 303Q for JMP; the second byte is the low-order address byte for our interrupt handler; and the third byte is the high-order address byte for our interrupt handler). This means that all we have to do is put the address of our interrupt handler, and 303Q for JMP, in the appropriate slot. For example, if we have an interrupt routine named INT4SE for the level 4 interrupt, all we have to do to install it is:

```
LXI   H,UIVEC+9
MVI   M,303Q      JMP AT UIVEC+9
LXI   H,INT4SE
SHLD UIVEC+10     ADDRESS OF HANDLER
*                 AT UIVEC+10
*                 AND UIVEC+11
```

Now whenever a level 4 interrupt occurs, the RST 4 causes a jump to 40Q, which jumps to UIVEC+9, which jumps to INT4SE.

Note: Definitions for UIVEC and .MFLAG are contained in the file MTR.ACM on the "HDOS Software Tools" disk.

Normal HDOS interrupt environment

What does HDOS normally put in the UIVEC area? In other words, which interrupts does HDOS normally process? I wrote a program to find out and Table 1 shows the results.

HDOS normally provides an interrupt handler for the clock (UIVEC+0), the system console (UIVEC+6), and I/O 7 (UIVEC+18). If you're wondering why they do so for the I/O 7 interrupt, this is because UIVEC+18 is used as the entry point for all the HDOS system calls (SCALLs). This address should not be altered, since to do so would destroy the ability to make SCALLs. Note also that HDOS sets bit 0 of .MFLAG to 1, which allows for user programming of the clock interrupt. HDOS has loaded a JMP instruction (303Q) at each place, so we don't have to worry about loading it ourselves (all we need to do is set the handler address). The address 034.027A, loaded for interrupts 2, 4, 5, and 6, is between the end of the monitor ROM and the UIVEC area.

This is the address of an EI, RET sequence in the SY driver which in effect does nothing. All it does is turn interrupts back on and return to the interrupted program. *Note:* this is a good programming practice. If HDOS didn't provide a service routine for one of the interrupts, and that interrupt occurred, the result could be a system crash. An operating system should provide a routine (even if it does nothing) for every possible interrupt.

This brings up a very important point about interrupt programming under HDOS.

If we are going to tamper with the normal HDOS interrupt environment during the duration of our program, and our program is going to return to HDOS when it's done, we had better make sure that the normal HDOS interrupt environment is restored before our program terminates. This means that before we load a new interrupt routine address in the UIVEC area, we must save the one that is currently there, and put it back before our program exits back to HDOS.

It should be noted that interrupt 5 is used by the H47 eight-inch floppy system, so if you have this equipment,

LOCATION	INSTRUCTION	ADDRESS	INTERRUPT
UIVEC+0	303Q	356.155A	clock
UIVEC+3	303Q	034.027A	single step
UIVEC+6	303Q	365.002A	I/O 3 (console)
UIVEC+9	303Q	034.027A	I/O 4
UIVEC+12	303Q	034.027A	I/O 5
UIVEC+15	303Q	034.027A	I/O 6
UIVEC+18	303Q	362.214A	I/O 7

.MFLAG = 0201Q User Clock Flag is SET

Table 1: Normal contents of the UIVEC area

```
DS      3       JUMP TO CLOCK PROCESSOR  (UIVEC+0)
DS      3       JUMP TO SINGLE STEP PROCESSOR (UIVEC+3)
DS      3       JUMP TO I/O 3    (UIVEC+6)
DS      3       JUMP TO I/O 4    (UIVEC+9)
DS      3       JUMP TO I/O 5    (UIVEC+12)
DS      3       JUMP TO I/O 6    (UIVEC+15)
DS      3       JUMP TO I/O 7    (UIVEC+18)
```

Listing 3: The UIVEC area

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interrupt 5 is not available for other purposes.

Interrupt environment of the 8250

Since the things you will most probably be writing interrupt handlers for are the serial I/O ports and the system console, a discussion of the 8250 Asynchronous Communications Element (ACE), which controls these ports, is in order.

On the H/Z89, 8250 ACEs control the ports on the HA–88–3 serial card, and the system console port. The serial card ports are at addresses 320–327Q, 330–337Q, and 340–347Q. These addresses correspond to the Data Communications Equipment (DCE) serial port, the Data Terminal Equipment (DTE) serial port, and the Line Printer (LP) serial port, respectively. The system console (H19 part of the H/Z89) is located at addresses 350–357Q. On the H8, 8250 ACEs control the four ports on the H8–4 serial I/O card. The addresses of these ports are determined by the address jumpers for each port. (Note, however, that HDOS requires the system console and LP ports to have the same addresses as above; see your HDOS manual.) Each 8250 is implemented with seven eight-bit registers. (There is actually room for eight registers at each port, but only seven are used.) They appear in order; in other words, register 0 for the system console is at address 350Q, register 1 at 351Q, register 2 at 352Q, ..., register 6 at 356Q. Each register is accessed by doing an IN (for read) and OUT (for write) instruction with the appropriate address. For the purpose of interrupt processing, we need only worry about registers 0, 1, and 2. (For output interrupts, we will also need to look at register 5.)

Register 0 is where characters are put for output, or read from for input. This register is actually two registers, one of which is selected depending on whether we read from or write to this register. If we write to this register, with an OUT instruction, the character output is placed in the Transmitter Holding Register, and is output to the device. If we read from this register, with an IN instruction, then we read a character from the Receiver Buffer Register. (Before we do this read, we should make sure there is a character there. In the case of an interrupt handler, the interrupt tells us this.)

Register 1 is the Interrupt Enable Register; we use this register to tell the 8250 when to generate an interrupt.

Bit 0: When set to a logic 1, this bit enables the Received Data Available Interrupt. Bit 0 is reset to logic 0 when we read the Receiver Buffer Register (IN from register 0). We set this interrupt to do input interrupt processing. Whenever a character is received and is ready for us to read (from register 0), an interrupt is generated. Note that this bit is reset automatically when we read the character. Before it returns, one of the things our handler needs to do is set this bit back to 1.

Bit 1: This bit enables the Transmitter Holding Register Empty Interrupt when set to a logic 1. Bit 1 is reset to logic 0 when we write to the Transmitter Holding Register (OUT to register 0). We set this interrupt to do output interrupt processing. Whenever the Transmitter Holding Register is empty (i.e., it is O.K. to send the next character by doing an OUT instruction for register 0), an interrupt is generated. Note again that this bit is also reset automatically.

Bit 2: This bit enables the Receiver Line Status Interrupt when set to a logic 1. Bit 2 is reset to logic 0 when we read the Line Status Register. This interrupt is generated on transmission errors: overrun, parity, framing, or break. It is useful for making sure characters are sent correctly, and for detecting when the BREAK key has been hit. We won't be too concerned about this type of interrupt.

Bit 3: When set to a logic 1, this bit enables the Modem Status Interrupt. Bit 3 is reset to logic 0 when we read the Modem Status Register. (This interrupt is generated when the following status lines change state: CTS, DSR, RI, or RLSD.) It is used to tell when the device has changed state, either when it comes on or when it goes off. We won't worry about this type of interrupt.

Register 2 is the Interrupt Identification Register. Remember that on the H/Z89 and H8, each device generates one interrupt (3, 4, or 5). Well, suppose we have Bit 0 and Bit 1 set in the Interrupt Enable Register (IER), and an interrupt occurs. Which interrupt is it? Is it an output or an input interrupt? The CPU jumps to the same routine in either case, so we need some way to ask the 8250 which interrupt it was. This is the function of the Interrupt Identification Register (IIR).

Bit 0: This bit is 1 if there is no pending interrupt, and 0 if there is a pending interrupt. Bit 0 tells us if this device has generated an interrupt or not.

Bits 1 and 2: These are the important bits; they tell us what interrupt has occurred. Considered as a two-bit field, these bits take on four different values (0–3):

0: Modem Status Interrupt (bit 1 = bit 2 = 0).

1: Transmitter Holding Register Empty (bit 1 = 1, bit 2 = 0).

2: Received Data Available (bit 1 = 0, bit 2 = 1).

3: Receiver Line Status (bit 1 = bit 2 = 1).

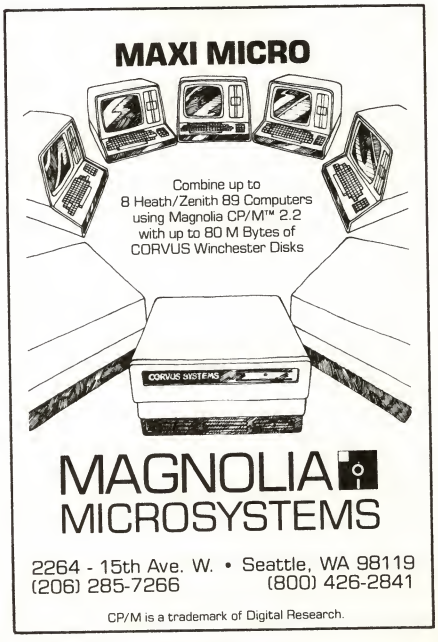
For doing output interrupts, we will also need to look at register 5, the Line Status Register. The bit we are interested in is bit 5, the Transmitter Holding Register Empty (THRE) bit.

Bit 5: Indicates that the 8250 is ready to accept a new character for transmission. In addition, this bit causes the 8250 to issue an interrupt to the CPU when the Transmit Holding Register Empty Interrupt enable is set to logic 1. As you see, this bit is the source of the output interrupts, and is therefore of some interest to us. More later.

In summary, we need to do the following things when programming the 8250 ACE to do interrupts. We must first initialize the IER so that the appropriate interrupts are turned on. Then, when an interrupt occurs, we check the IIR to see which type of interrupt occurred (this step can be eliminated if only one type of interrupt is enabled), process it, and reset the appropriate bit in the IER. *Important Note:* The setting of the IERs for all the ACEs is also part of the normal interrupt environment of HDOS. We should save these values before setting them to what we want, just as we saved the jump values in the UIVEC area, so that they can be restored when our program exits back to HDOS.

Interrupt programming example

Let's now put together all the information we have about interrupt programming, and write a handler. Suppose we want to communicate with a CRT terminal connected to an 8250 port at 320–327Q (the DCE port on the H/Z89, or the standard AT: terminal location on the H8). Let's write an interrupt driver which does both input and output. Then we can save up input characters until we're ready to read them, and not be slowed down by having to do output one character at a time directly to the port. Assume that the port is set to INTR 4 so that it doesn't interfere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with the console. (If we set INTR 3, the DCE port and the system console generate the same interrupt. This is O.K., but now we must first look at bit 0 in both the IIR registers (at 322Q and 352Q) to see which device interrupted, then at the appropriate IIR register to see whether an input or output interrupt occurred.)

Our handler will also need two buffers to hold characters. Since more than one character may come in from the CRT terminal before we get around to reading any, an input buffer (call it IBUFF) is needed to store them. We will need two pointers into this buffer: an input pointer (call it IIPTR), and an output pointer (call it IOPTR). IIPTR points to the place where the interrupt handler should put the next character that comes in. IOPTR points to the next character the main program will read out of the buffer. We need to select a size for this buffer; let's choose 81 characters, since that is the length of one line on a regular CRT terminal (80 columns plus room for a RETURN).

Since we want to be able to output a group of characters at a time, we need an output buffer (call it OBUFF). We need two pointers into this buffer, too: an output pointer (call it OOPTR), and an input pointer (call it OIPTR). OOPTR points to the next character the interrupt handler is supposed to output, and OIPTR points to the place where the next output character will be placed in the buffer. We need a size for this buffer too; let's pick 257 characters, which will accommodate a disk sector (a convenient chunk of characters).

Now we need to think about how these buffers work. When IIPTR = IOPTR, then the input buffer is empty. (The main routine wants a character from the spot where the interrupt handler is going to put the next one, which means there isn't one there yet.) Our main routine needs to check whether IIPTR = IOPTR before it gets the character at IOPTR. If they are equal, then it must wait until they are not equal. When it does get a character, it increments IOPTR so that it points to the next spot in the buffer. Similarly, when the interrupt handler wants to put a character in the buffer, it puts the character at IIPTR, then increments IIPTR along to the next spot in the buffer. *But wait!* What happens when IIPTR or IOPTR gets up to 81 (the size of the buffer)? If we now increment, the pointer runs off the end of the buffer!!??

What we need to do is wrap the end of the buffer around to the start of the buffer, and make a "circular queue". Both the main routine and the interrupt handler must check their pointers after they are incremented. If the pointer now points past the end of the buffer, it needs to be reset to point at the start. In this way, IOPTR "chases" IIPTR through the buffer, over and over. This brings up the following problem. What if our main routine is very slow about reading characters out of the buffer, and the interrupt routine fills it up?

Well, when the interrupt routine has put 80 characters in the buffer, and none have been read out, IIPTR points to the spot in the buffer right before IOPTR. Now the 81st character comes along, the interrupt handler puts it at IIPTR, and increments IIPTR (or wraps it around). IIPTR now equals IOPTR!! The buffer is "empty", and all the characters were lost. The buffer was "overflowed", which caused it to be reset to empty. One way to "solve" this problem is to make the buffer bigger. Another is to ring bells and toot whistles. (Which is what HDOS does.) Note that we were really only able to put 80 characters in the buffer before it overflowed; this is one less than the buffer size. If we actually want the buffer to hold 81 characters, we need to make the buffer size 82 bytes.

The output buffer is similar. But now since we have some control over when we put characters in the buffer (when they're put in because of an interrupt, as with IBUFF, we have no control), let's make the following restriction. If OOPTR = OIPTR, then the buffer is empty. If OIPTR points to the spot before OOPTR, then the buffer is full, and we shouldn't put in any more. (This means either OIPTR is less than OOPTR, or OIPTR points to the last spot and OOPTR points to the first spot.) Note that this restriction means that the buffer size needs to be 257 bytes to hold 256 characters, just like IBUFF. When the main routine wants to put a character in the buffer, it checks to see if OIPTR points to the spot before OOPTR. If this is so, the buffer is full and it must wait until it is not so. Otherwise, it puts the character at OIPTR and increments (or wraps) OIPTR.

The interrupt handler first checks to see if OIPTR = OOPTR. If this is so, then the handler does nothing (buffer is empty). Otherwise, the handler gets the character at OOPTR, and increments (or wraps) OOPTR.

Now let's get down to the program. First, we will need a "startup" routine. This routine will initialize the buffers, load the interrupt handler address into the UIVEC area, and set the IER of the ACE. This routine should be called once at the start of our program. It's found in the first 17 instructions of Listing 4.

Instructions 1, 2, and 3 in Listing 4 initialize the input buffer by making IIPTR and IOPTR point to the same place (the first spot in the buffer, IBUFF). Similarly, instructions 4, 5, and 6 initialize the output buffer. Instructions 7, 8, 9, and 10 save the HDOS interrupt environment so that it can be restored when the program exits to HDOS. Instructions 11 and 12 disable interrupts from the DCE port. The reason for this instruction is that we are about to set *our* interrupt handler and *our* version of the IER, and we don't want any interference from what was there before. We don't want any interrupts

```
**
* EQUATES
*

UIVEC   EQU     040037A USER INTERRUPT VECTOR AREA
AC.CH   EQU     320Q    I/O REGISTER
AC.IER  EQU     321Q    INTERRUPT ENABLE REGISTER
AC.IIR  EQU     322Q    INTERRUPT IDENTIFICATION REGISTER
AC.LSR  EQU     325Q    LINE STATUS REGISTER
IINT    EQU     00000001B       INPUT INTERRUPT IN IER
OINT    EQU     00000010B       OUTPUT INTERRUPT IN IER
OUTINT  EQU     00000010B       OUTPUT INTERRUPT IN IIR
ININT   EQU     00000100B       INPUT INTERRUPT IN IIR
IMASK   EQU     00000110B       MASK FOR IIR
THRE    EQU     00100000B       THRE BIT OF LSR
IBSIZE  EQU     82      SIZE OF INPUT BUFFER
OBSIZE  EQU     257     SIZE OF OUTPUT BUFFER

**
* STORAGE
*

IBUFF   DS      IBSIZE  INPUT BUFFER
OBUFF   DS      OBSIZE  OUTPUT BUFFER
OOPTR   DW      1       OUTPUT POINTER FOR OUTPUT BUFFER
OIPTR   DW      1       INPUT POINTER FOR OUTPUT BUFFER
IOPTR   DW      1       OUTPUT POINTER FOR INPUT BUFFER
IIPTR   DW      1       INPUT POINTER FOR INPUT BUFFER
OLDINT  DW      1       STORAGE FOR OLD INTERRUPT VECTOR
OLDIER  DS      1       STORAGE FOR OLD IER REGISTER
```

Listing 4: Sample interrupt handler; beginning

from this device until we're ready (at instruction 16), so we turn them off. This is not absolutely necessary, but now we're sure nothing strange will happen if an I/O 4 interrupt occurs at 13, 14, 15, or 16. Instructions 13 and 14 load the address of the interrupt handler into the I/O 4 interrupt vector area of UIVEC. Instructions 15 and 16 set the Received Data Available interrupt of the port, i.e., they turn on the input interrupts. Note that the output interrupt (Transmitter Holding Register Empty) is not set. There are no characters to output since we just initialized the buffer, so there is no reason to interrupt merely because the transmitter holding register is empty (since we already know that it is). We'll see in a bit how this interrupt gets turned on.

There is one last point to make; it is essential that we initialize the buffer before we put in the handler address and set the IER. Remember that an interrupt can occur at any time. If we reverse the order, or mix up the steps, an I/O 4 interrupt might occur in the middle of the buffer initialization. Since the handler changes the pointers, very strange and undesirable things might occur. If we know interrupts are on, then we need to assume that an interrupt can happen at *any* time, after *any* instruction, and we need to think carefully about what might happen.

HDOS programming note: The DCE serial port at 320Q is not initialized by HDOS. This means that before we use it, it should be initialized. This startup routine is a good place to do that. There is a file on the "HDOS Software Tools Disk" called DVDIO.ACM; in this file is a routine called I8250 which will initialize an 8250 ACE. In between instructions 10 and 11 we would insert the following:

```
MVI     A,320Q      PORT ADDRESS IN A
LXI     H,BAUDR     BAUD RATE TO HL
CALL    I8250       INITIALIZE PORT
```

Bits 0–14 of BAUDR select the baud rate. (See the divisor latch information for the 8250 in your H8 or H/Z89 manuals for details: H/Z89 manual, p. 13–6.) Bit 15 of BAUDR is 0 for one stop bit, and 1 for two stop bits; to determine which way you set this bit, you need to look at the information about the peripheral you use.

Before moving on to the handler, the routine which restores the normal HDOS interrupt environment is found in Listing 5. This routine should be called right before our program exits back to HDOS. Again note that we turn off all interrupts from the port first, so that nothing weird happens.

The main handler is found in Listing 4: instructions 18 through 47. Instructions 18-21 save the values of all the registers on the stack. This saves the environment, so that we can return to the interrupted routine. Instructions 22-28 determine what type of interrupt occurred by looking at the IIR register and jump to the appropriate routine. Note that there is a "trap" at instruction 28 to catch "impossible" interrupts.

```
RESTOR  MVI     A,0
        OUT     AC.IER          TURN OFF PORT INTERRUPTS
        LHLD    OLDINT
        SHLD    UIVEC+10        PUT IN OLD HANDLER
        LXI     H,OLDIER
        MOV     A,M
        OUT     AC.IER          SET OLD INTERRUPTS
        RET
```

Listing 5: Routine to restore the normal HDOS interrupt environment

```
**
* INTERRUPT SET UP ROUTINE
*
START   LXI     H,IBUFF         INITIALIZE INPUT BUFFER  1
        SHLD    IOPTR                                    2
        SHLD    IIPTR           IOPTR=IIPTR=IBUFF        3
        LXI     H,OBUFF         INITIALIZE OUTPUT BUFFER 4
        SHLD    OOPTR                                    5
        SHLD    OIPTR           OOPTR=OIPTR=OBUFF        6
        LHLD    UIVEC+10        GET CURRENT I/O 4 VECTOR 7
        SHLD    OLDINT          SAVE IT                  8
        IN      AC.IER          GET CURRENT IER          9
        STA     OLDIER          SAVE IT                  10
        MVI     A,0                                      11
        OUT     AC.IER          TURN OFF PORT INTERRUPTS 12
        LXI     H,HANDLR                                 13
        SHLD    UIVEC+10        PUT IN NEW HANDLER       14
        MVI     A,IINT                                   15
        OUT     AC.IER          SET INPUT INTERRUPT      16
        RET                                              17
```

Listing 4: Sample interrupt handler; instructions 1-17

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These interrupts should never occur, but they might, so our routine should do something sensible (in this case restore the environment, and return).

If the interrupt was for input, then we jump to INHND. Instructions 29-32 get the character, and put it in the buffer at IIPTR. Note that the eighth (or parity) bit is stripped off at instruction 31; this is a safeguard, since most CRT terminals only send seven-bit ASCII. Remove this instruction if you want all eight bits. Instructions 33-38 increment the pointer, wrapping it around to IBUFF when necessary. Instructions 39-41 set the input interrupt bit in the IER. (Remember that the ACE automatically resets it when an interrupt occurs.) This is done by ORing the bit in; in this way, the other bits of the IER are not disturbed. Instructions 42-47 restore the environment of the interrupted routine we pushed onto the stack. Note the EI instruction (46); don't forget to do that. Remember that the CPU interrupts were automatically turned off when the interrupt occurred, so we need to be sure to turn them back on.

If the interrupt was for output, then we jump to OUTHND.

Going further through the listing, instructions 48-51 check to see whether the buffer is empty by comparing OIPTR with OOPTR. If this is so, we restore the registers and return by jumping to DONE at instruction 52. Otherwise, instruction 53 gets the character at OOPTR and stashes it in the B register. Instructions 54-59 update OOPTR so that it points to the next spot in the buffer. Instructions 60-64 output the character saved in the B register at instruction 53, and turn on the Transmitter Holding Register Empty interrupt so that an interrupt is generated after this character is output. Instruction 65 jumps to DONE which restores the registers, enables interrupts, and returns.

But how do the output interrupts get turned on in the first place? Remember that the START routine didn't bother to turn them on. Let's look at the segments of the main program which do the other half of the I/O.

First, let's look at the "read" routine which gets characters out of IBUFF. It's found in Listing 4: instructions 66 through 77.

Instructions 66-70 implement a wait loop which waits until the buffer has something in it (i.e., when IIPTR is not equal to IOPTR). If we are in this loop, what we're waiting for is to be interrupted by an input from the port, which will put a character in the buffer and change IIPTR. Instruction 71 gets the character at IOPTR and puts it in the B register. Instructions 72-77 bump IOPTR along to the next spot.

Remember that an interrupt can occur at any time. One thing we need to check is whether an input interrupt occurring at some point in this routine may cause unwanted things to happen under some circumstances. Well, the handler changes IIPTR, and this routine changes IOPTR, so there is no problem there. This routine does look at IIPTR, though; could this cause a problem? As it turns out, this only matters if the value of IIPTR causes a wait, but at that time, we *want* the handler to come along and change the value. That is what terminates the wait. So in this case, interference by the interrupt is desired.

Now let's look at the "write" routine which puts characters into OBUFF. It's found in Listing 4: instructions 78 through 104. Assume the character to be output is in the B register, and that this is a sub-routine which returns when it's done.

The first thing we need to do is to check to see if the buffer is full, i.e., OIPTR points to the spot right before OOPTR. To do this, we increment OIPTR (or wrap), and test it against OOPTR. Instructions 78-84 do the increment and place the result in the DE register. Instructions 85-87 are the loop; note that we detour through WWAIT (instructions 101-104) if we are looping. WWAIT makes sure output interrupts are on; if we are doing the loop, and output interrupts are off, we will loop forever because the interrupt handler is what changes OOPTR and terminates the loop. We test whether interrupts are on by looking at the Transmitter Holding Register Empty (THRE) bit in the Line Status Register (LSR). This may seem strange. Why not look at the interrupt enable bit in the IER?

The reason for this is a function of the way most ACEs work. Serial output is done in two registers, the Transmitter Holding Register (THR), and the Transmitter Shift Register (TSR). When a character is output, it is first transferred from the THR to the TSR, then output over the serial line from the TSR. In the event that the TSR is empty when a new character is placed in the THR, this transfer happens immediately and

```
HANDLR  PUSH    PSW             SAVE REGISTERS              18
        PUSH    B                                           19
        PUSH    D                                           20
        PUSH    H                                           21
        IN      AC.IIR          FIND OUT WHICH INTERRUPT    22
        ANI     IMASK                                       23
        CPI     OUTINT                                      24
        JZ      OUTHND          IS OUTPUT                   25
        CPI     ININT                                       26
        JZ      INHND           IS INPUT                    27
        JMP     DONE            IS SPURIOUS                 28

**
* INPUT HANDLER
*

INHND   IN      AC.CH           GET THE CHARACTER           29
        LHLD    IIPTR           CHARACTER GOES HERE         30
        ANI     0177Q           TOSS PARITY BIT             31
        MOV     M,A             PUT IN BUFFER               32
        INX     H               INCREMENT POINTER           33
        LXI     D,IBUFF+IBSIZE  WRAP POINT                  34
        CALL    LCOMP           COMPARE                     35
        JNZ     INDONE          NO WRAP                     36
        LXI     H,IBUFF         WRAP                        37
INDONE  SHLD    IIPTR           STORE NEW POINTER           38
        IN      AC.IER                                      39
        ORI     IINT            RESET INPUT INTERRUPT       40
        OUT     AC.IER                                      41
DONE    POP     H               RESTORE REGISTERS           42
        POP     D                                           43
        POP     B                                           44
        POP     PSW                                         45
        EI                      INTERRUPTS BACK ON          46
        RET                                                 47

**
* DOES A 16 BIT COMPARE OF THE H AND D REGISTERS
*

LCOMP   MOV     A,H
        XRA     D
        RNZ
        MOV     A,L
        XRA     E
        RET
```

Listing 4: Sample interrupt handler; instructions 18-47

quickly. Let's go back and look at the code in OUTHND at instructions 61-64. Assume that the TSR is empty when we output the character into the THR at instruction 61. The character is transferred rapidly to the TSR, and the THR is now empty. Instructions 62-64 turn on the THRE interrupt, but the register is already empty so this interrupt will never occur! If we now look at the enable bit in the IER, it indicates that the THRE interrupt is on, but in fact we are waiting for the transfer of data from the THR to the TSR, an event which has already occurred. We get around this problem by checking to see if the THR is empty. If it is, either interrupts are really off, or we missed the event.

```
OUTHND  LHLD    OIPTR           CHECK FOR EMPTY          48
        XCHG                                             49
        LHLD    OOPTR                                    50
        CALL    LCOMP                                    51
        JZ      DONE            EMPTY...DO NOTHING       52
        MOV     B,M             GET THE CHAR             53
        INX     H               INCREMENT POINTER        54
        LXI     D,OBUFF+OBSIZE  WRAP POINT               55
        CALL    LCOMP           COMPARE                  56
        JNZ     OTDONE          NO WRAP                  57
        LXI     H,OBUFF         WRAP                     58
OTDONE  SHLD    OOPTR           STORE NEW POINTER        59
        MOV     A,B             CHAR TO (A)              60
        OUT     AC.CH           SEND IT                  61
        IN      AC.IER                                   62
        ORI     OINT            RESET OUTPUT INTERRUPT   63
        OUT     AC.IER                                   64
        JMP     DONE                                     65
WAIT    LHLD    IIPTR           GET IIPTR                66
        XCHG                    IIPTR TO DE              67
        LHLD    IOPTR           GET IOPTR                68
        CALL    LCOMP           COMPARE                  69
        JZ      WAIT            WAIT WHILE BUFFER EMPTY  70
        MOV     B,M             GET CHAR AT IOPTR        71
        INX     H               INCREMENT POINTER        72
        LXI     D,IBUFF+IBSIZE  WRAP POINT               73
        CALL    LCOMP           COMPARE                  74
        JNZ     GEDONE          NO WRAP                  75
        LXI     H,IBUFF         WRAP                     76
GEDONE  SHLD    IOPTR           STORE NEW POINTER        77
WRITE   LHLD    OIPTR           CHECK FOR FULL BUFFER    78
        INX     H               INCREMENT OIPTR          79
        LXI     D,OBUFF+OBSIZE  WRAP POINT               80
        ALL     COMP            COMPARE                  81
        JNZ     WCONT1          NO WRAP                  82
        LXI     H,OBUFF         WRAP                     83
WCONT1  XCHG                    NEW OIPTR TO DE          84
MWAIT   LHLD    OOPTR                                    85
        CALL    LCOMP           SEE IF NEW OIPTR = OOPTR 86
        JZ      WWAIT           WAIT IF TRUE (BUFF FULL) 87
        LHLD    OIPTR                                    88
        MOV     M,B             PUT CHAR IN BUFFER       89
        XCHG                    NEW OIPTR TO HL          90
        SHLD    OIPTR           STORE IT                 91
        IN      AC.LSR                                   92
        ANI     THRE            SEE IF INTERRUPT ON      93
        JNZ     OIREST          RESTART INTERRUPTS       94
        RET                                              95

* RESTART OUTPUT INTERRUPTS
*
OIREST  PUSH    PSW             "SIMULATE" AN INTERRUPT  96
        PUSH    sB                                       97
        PUSH    D                                        98
        PUSH    H                                        99
        JMP     OUTHND                                   100

* DO NOT WAIT WITH INTERRUPTS OFF!!!!!
*
WWAIT   IN      AC.LSR                                   101
        ANI     THRE            SEE IF INTERRUPT ON      102
        CNZ     OIREST          RESTART INTERRUPTS       103
        JMP     MWAIT                                    104
```

Listing 4: Sample interrupt handler; instructions 48-104

In either case, we want to get the interrupts started again. You can convince yourself that this works by thinking about the environment. The handler's job is to keep the ACE busy doing output; as soon as the THR is emptied, an interrupt occurs and the handler shoves another character into it, if possible. If we think interrupts should be on, but the THR is empty, then something has gone wrong, and we need to kick the handler as follows.

If the interrupt is off, we can restart it by calling OIREST (instructions 96-100). This is an interesting routine; it "simulates" an interrupt by pushing the usual stuff and jumping to the handler. The last thing the handler does is turn on the interrupt bit in the IER, so hooray! We've just started up the interrupts.

Note: It is very important that the interrupt handler not interrupt itself, as this may garbage up the value of OOPTR. When a hardware interrupt occurs, interrupts are disabled by the CPU, so this is not a problem. When we generate a "software" interrupt by calling the handler, we must be sure that the interrupt from the device is off. In this case, we know it's off because we looked at the IER register first.

Instructions 88 and 89 store the character in the buffer at OIPTR. We now need to increment the pointer—but we already have. The value is in the DE register, and instructions 90 and 91 store it at OIPTR. Instructions 92-94 now do the same thing we did in the loop: make sure interrupts are on. This handles the case of putting the first character in an empty buffer. If the buffer is empty when write is called, output interrupts are off. We don't wait; we put the character in the buffer, and we generate a "software" interrupt, which gets the output going. This is how we initially get output interrupts turned on.

Again we need to check for interference. The write routine alters only OIPTR, and the handler only OOPTR, so there is no problem there. The handler looks at OIPTR, but interrupts are off so that's no problem. WRITE looks at OOPTR, but just as in the input case this only matters when looping. And in that case we want an interrupt to change OOPTR and terminate the loop.

In summary, here are some important points to remember. Input interrupts are controlled by the interrupting device; all we need to do is keep them turned on. Output interrupts, on the other hand, are more under our control. We need to turn them on when there is something to output, and keep them on until there is nothing to output. If we put in a loop which waits for some event (like the change in a pointer value) caused by an interrupt, then we must be sure that the interrupt is turned on; otherwise, we will loop forever. Look

carefully at any variables shared by the main routine and the handler, and make sure nothing undesirable happens if an interrupt occurs and changes the values. Finally, try to keep the interrupt handlers short. Remember that CPU interrupts are turned off until the handler turns them on with an EI instruction. During this time, interrupts from other devices (like the clock) may be lost, so keep "interrupt time" to a minimum. Write efficient code, and keep the handlers simple.

A note to those concerned about clocks: most "clocks" have a built-in fudge factor to make up for "ticks" lost to interrupt processing (the system console is interrupt driven for input). If you write an interrupt routine, and use it a lot, you may have to alter your fudge factor to get accurate time-keeping.

Summary

The programming example given in this article is relatively simple, but it will probably cover most people's needs. In order to keep the example simple, some interrupt programming issues—such as interrupt nesting and device polling—were glossed over. Remember that one of the things we want to do is minimize the time that CPU interrupts are off. We can control this with the EI and DI instructions. It is possible to turn on interrupts before our handler is finished, and maybe turn them back off later. This means that the interrupt handler can be interrupted. (Maybe even by itself!) This can cause some very sticky problems.

Another related area is the problem of critical sections. Remember that I said to check very carefully when two routines (usually a program and an interrupt handler) access the same variable. Suppose I have a program A and an interrupt handler B, and that these two routines share a common variable called COUNT. Suppose that both A and B alter COUNT. Altering a memory location is usually done this way: "1. Get current value from memory into register. 2. Alter value in register. 3. Store new value back into memory." Now suppose A is running and it wants to alter COUNT. It gets the current value, alters it, but is interrupted by B in between the alteration and the store. Now B alters COUNT. It gets the current value (which is the same value A got since A hasn't written out its new value yet), alters it, and writes out its new value. Now B returns, and A starts up where it left off: it does the store of its value erasing the alteration made by B!!! Our value of COUNT is now incorrect, since the alteration by B was lost. We can solve this problem by putting a DI instruction before the alteration steps in A, and an EI instruction after them. In this way B is prevented from "getting in". Such a section of a program is called a "critical section"; it needs to be protected from interruption.

You should now know enough about the interrupt environments of the various system components to write your own handlers. Study the example carefully, and make sure you understand what is going on. Good luck, and have fun.

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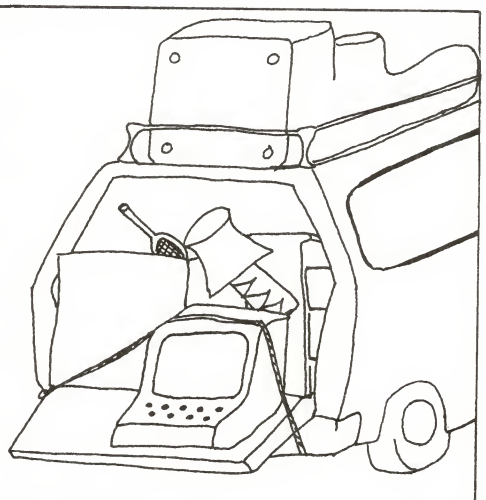

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Supplier Notes

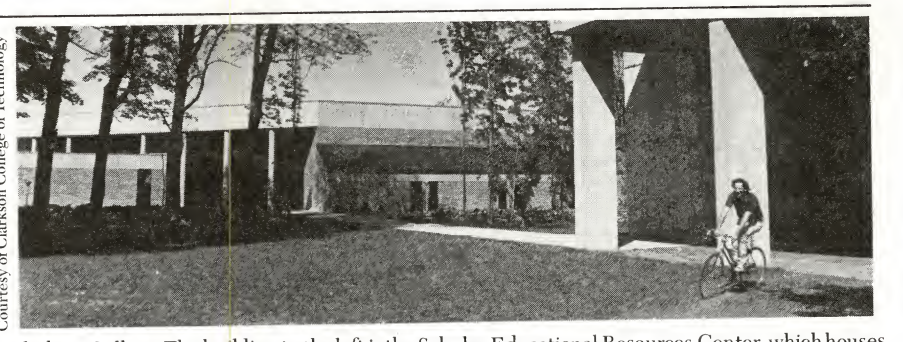
ALL CLARKSON COLLEGE STUDENTS TO GET Z100s

Zenith's Z100 series microcomputer will play a key role next September in a far-sighted venture in computerization at the Clarkson College of Technology. Beginning with the members of next year's freshman class, every one of Clarkson's 3800 students will be issued a Zenith Data Systems personal computer. Clarkson is a private, co-educational college in Potsdam, New York which stresses study in science, engineering, and management.

Clarkson's program will be among the first of its kind in the United States. College President Robert Plane considers the program essential to a school with Clarkson's technical orientation. "We're preparing our students to excel in a computer-dominated society," he stated.

This Fall, roughly 1000 freshmen will receive the Zenith ZF100-21 lowprofile desk top computer with one disk drive, accompanied by a monochrome monitor. Some systems may also be immediately available to other students. Students will pay $200 each semester plus a one-time $200 maintenance fee to use the systems, which will then belong to the students when they graduate. The balance of the cost of furnishing the systems, which cost well over $4000 apiece, will be borne by restricted grants and by Zenith Data Systems, which will provide the systems at a discounted price due to the large size of the order and the positive publicity which should result. Each student will also receive a preliminary software package including BASIC, FORTRAN, Pascal, and Multiplan, a spreadsheet program from Microsoft Corporation.

In the future, Clarkson will link all the students' computers in a network with each other, with faculty computers, and with the college library. The installation of student computers represents one phase of a process of computerization which began in the 1970s, when lack of library space had become a critical problem. Clarkson's solution, the Andrew S. Schuler Educational Resources Center, combines the school's library, a computing center housing an IBM 4341 MOD II mainframe, and various audio-visual educational facilities. To conserve library space and to anticipate coming trends, most library acquisitions are now made in the form of microforms or electronic storage media. The decision to give preference to electronic media over printed matter received censure initially from critics concerned about the possible obsolescence of books, but operation has proceeded successfully so far. The college's growing computer network also extends to the Ohio College Library Center, a national library network.



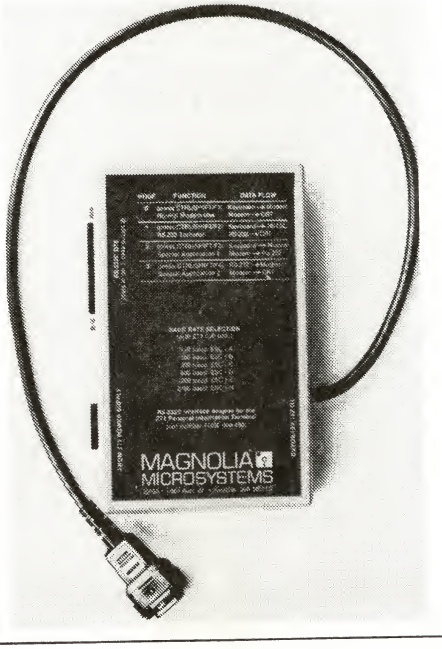
Courtesy of Clarkson College of Technology

Clarkson College: The building to the left is the Schuler Educational Resources Center, which houses the mainframe computer and the library. In the right foreground is part of the Science Center.

Asked why they chose the Zenith Z100 series computers for their students, Clarkson officials stress flexibility of applications as a major criterion. Because the Z100 uses both 8-bit and 16-bit microprocessors (Intel's 8085 and 8088), it can run software requiring either device, and serve a wider variety of student requirements. Another major factor in the choice of the Zenith machine was its graphics capabilities, which can meet the technical needs of science and engineering students.

One benefit Clarkson administrators foresee for students using personal computers is an increase in the time available for creative thinking when computers take over some of the students' more tedious chores. For instance, a computer model can simulate a scientific experiment, an engineering construction project, or a management situation. By manipulating variables on their computers, students will be able to see the results of implementing various options more quickly than if they had worked through every problem themselves, in the laboratory or on paper. Another anticipated result of the Clarkson program is more individualized instruction. Faculty members will be better able to produce programs of study tailored to the needs of individuals students, who will follow the lessons at their own paces. Networking the computers will enhance communication between students and faculty, which Clarkson officials hope will both speed and personalize the teaching process.

President Plane summarized the motivation behind Clarkson's trailblazing program in this way: "I an convinced that Carl Sagan is correct in predicting that the next development in human intelligence will be a partnership between intelligent humans and intelligent machines. That intellectual development will begin at the college level, when Clarkson courses in all disciplines are aided by student use of the personal computer." The choice of Zenith's personal computer to be the intelligent partner for Clarkson students testifies to the quality and flexibility of the new machine.



RS232 SUPPORT FOR ZT1

Magnolia Microsystems is now shipping an RS 232 Interface Adapter for the Zenith ZT1 personal information terminal. The ZT1 terminal contains an integral 300 baud modem for communicating with computers over telephone lines. This new interface allows it to also function as an RS232 terminal to communicate with computers at the user's site.

The interface plugs in between the ZT1 keyboard and power supply, supporting all data rates available from the ZT1 (110 through 2400 baud). Retail price of the unit is $69 with OEM, dealer, and distributor margins available.

Instructions are printed on the unit itself for ease of use. An RS423 version is available on special order.

For additional information, contact Magnolia Microsystems, Inc., 2264 15th Avenue West, Seattle, WA 98119, 206/285-7266 or 800/426-2841.

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16K ADD-ON RAM BOARD for H/Z 88-90-$120.00. *Video output boards* to send CRT image to TV monitor, provides simultaneous viewing on both displays for group presentations — $75.00. Sjulstad Engineering, 503 E. Fremont, Northfield, MN 55057, 507/663-3391.

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FCOPY conveniently transfers disk files; $7 (5" disk, instructions, postage); requires 48K, CP/M. ICS, 3734 Twin Lakes Ct., Baltimore, MD 21207.

FORTRAN support for HDOS: overlay, 9511, sort, console input, HDOS interface libraries; MICROCORE graphics package. MICROTRAN, 76 Flintwell Way, San Jose, CA 95138.

MICRO MEDIA MAGAZINE, a floppy Disk-Based Publication for the H19, H89, or Z89. For more information and a "FREE" Software Catalog, write Micro Media Magazine, Dept. SE, P.O. Box 402286, Garland, TX 75040.

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WANTED: Back issues of *REMark* (2-11), *Buss* (1-33), Lucidata Pascal manual. Dave Mann, HQ USAREUR Box 627, APO NY 09403.

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Luminaries

Hal Glatzer is a professional writer, so how a word processor performs is important to him. He has written a book on the subject, as it happens: *Introduction to Word Processing*, published by Sybex. (In the Fall 1982 *Sextant*, he took a somewhat more hardware-oriented tack, looking at Magnolia Microsystems.)

Kenneth A. Patrick's perspective on spreadsheets is perhaps shaped as much by a technical background (mainframe computers) as by accounting or financial experience. But having his own consulting business does spur an interest in easing bookkeeping burdens.

James A. Pilarski offered us his review of the C.D.R. disk controller board when he was at the National HUG Conference. The submission was fortuitous, we thought, since *his* introduction allowed *us* to avoid writing a longer preface to the disk controller survey.

Aaron Reynolds has to know all about the innards of the Heath Disk Operating System (HDOS) and not just how it handles doing more than one thing at a time. His company, PowerR, offers HDOS graphics and utility software to the Heath/Zenith marketplace.

John C. Roos has more than an academic or hobbyist's interest in increasing his H11's speed. He has over eighteen years' experience in radio frequency and microwave system design. And he's used his H11 for modelling and analysis of electronic circuits and for analysis of experimental radio propagation data.

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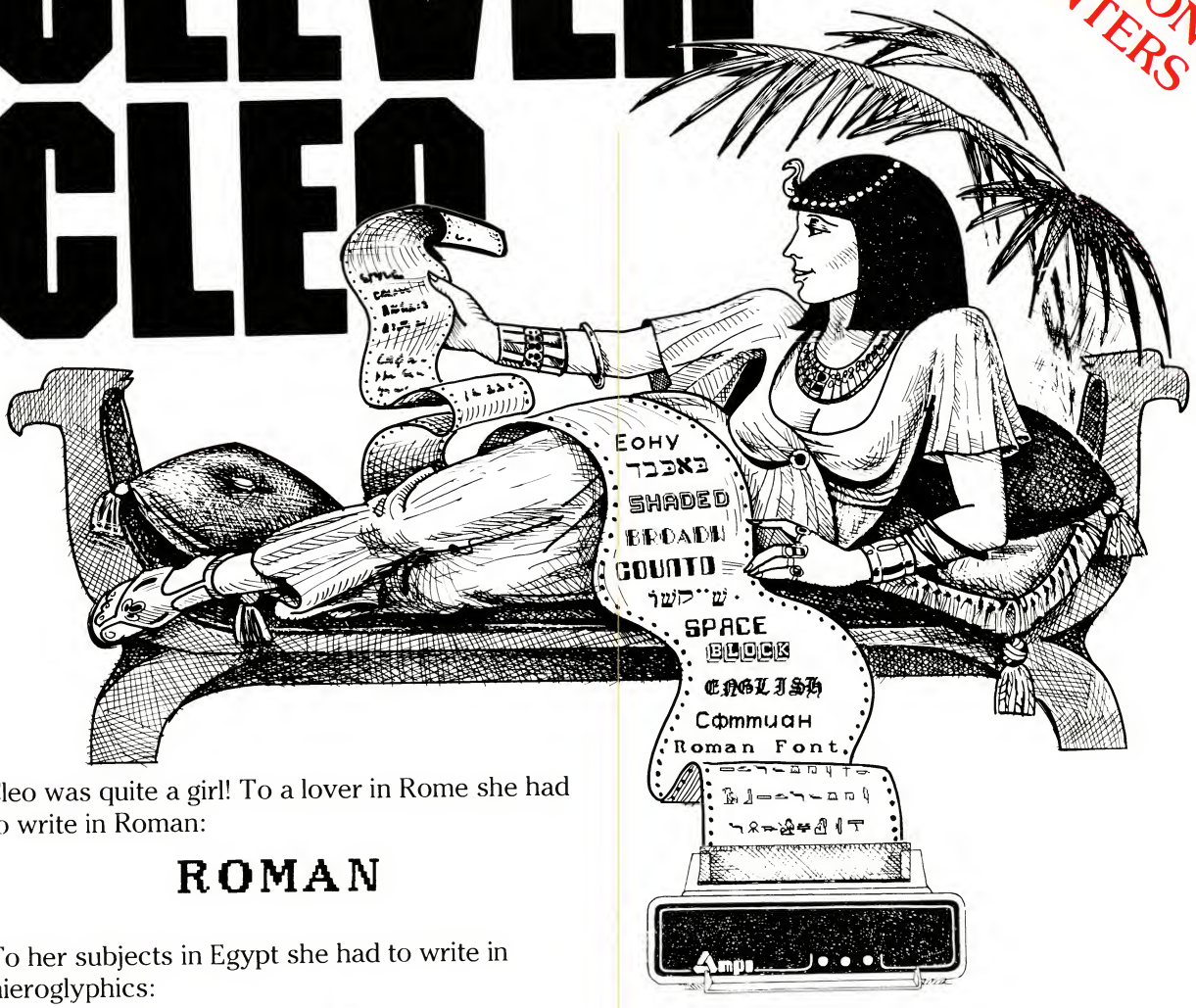
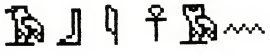


Cleo was quite a girl! To a lover in Rome she had to write in Roman:

ROMAN

To her subjects in Egypt she had to write in hieroglyphics:



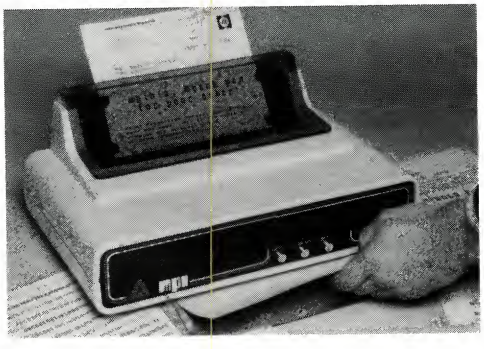
And when she wrote to the Israelites, she obviously had to use Hebrew:

דוד בא

It's a good thing she had an MPI graphics printer available that could handle an unlimited number of print fonts. And it's even more incredible that Cleo's MPI printer was price competitive with the inexpensive printers from overseas. Yes

Cleo was **Clever**

If you have letter writing chores, don't trust them to a mere mortal. Get an MPI Printer and make your MARC in society.



mpi

The Printer People
Micro Peripherals, Inc.
4426 South Century Drive
Salt Lake City, Utah 84107
(801) 263-3081

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Coming Attraction:

The Heath/Zenith Community Goes to the Faire

John Walker

Courtesy of S.F. Visitors Bureau, photo by Sandor Balatoni

The Eighth West Coast Computer Faire will be held in San Francisco on the weekend of March 18-20, 1983. The Faire is the oldest and largest gathering for the microcomputer industry. In previous years, it has also been the largest single meeting of Heath/Zenith users. (See the Summer 1982 issue of *Sextant* for a look at the 1982 Faire.) This time, it will still be in the "big three" of Heath user gatherings: behind the National Heath Users' Group Conference, and possibly even behind the regional conference hosted by the Capital Heath Users' Group (CHUG) in the Washington, D.C., area. (See the report elsewhere in this issue on the first HUG conference. The CHUG regional, held in November 1982, will be covered in the Spring issue.)

Some firsts

The 1982 Faire was the first time that independent suppliers to the Heath/Zenith community pooled resources to get together in a large island display area. At that time, the island was rented and coordinated by *Buss: The Independent Newsletter of Heath Co. Computers*, *Sextant*'s sister publication. This year, the same area (and more) has been rented by Heath/Zenith—both for their own exhibit and for renting out to independents. As far as we know, this is the first time a manufacturer has engaged in such cooperation with independents. There are eight suppliers that will be renting booth space from Heath/Zenith: C.D.R. Systems, Commsoft, D-G Electronic Developments, Evryware, Kres Engineering, Micro Peripherals, Inc. (MPI), The Software Toolworks, and Trionyx Electronics.

Other independent Heath/Zenith suppliers will have exhibits immediately next to the Heath/Zenith area: Buss/Sextant and Magnolia Microsystems.

Besides the independent suppliers and the Heath/Zenith products on exhibit, the Heath Users' Group will also be part of the Heath/Zenith display. And, as at previous Faires, there will also be a meeting for HUG members and other interested parties. As usual, we can hope to see questions fielded by Barry Watzman, Heath/Zenith computer product line manager. By March, he may be able to tell us more about Z100 software developments than he could at the National HUG Conference last August.

And other stuff in general

For those for whom the world of Heath/Zenith computers, users, and suppliers is not enough, the Faire will be its usual smorgasbord. There will be the usual mob scene in Brooks Hall (in the basement, sort of) with smaller companies selling their wares in a bazaar-like atmosphere. In the main hall, there will be large spiffy displays meant to impress us with their professionalism more than to get us to buy something on the spot. And there will be everything in between, including user groups, public policy associations, and any number of otherwise-unclassifiables. As well, there'll be seminars, demonstrations, lectures, panels, and other meetings going on practically all the time.

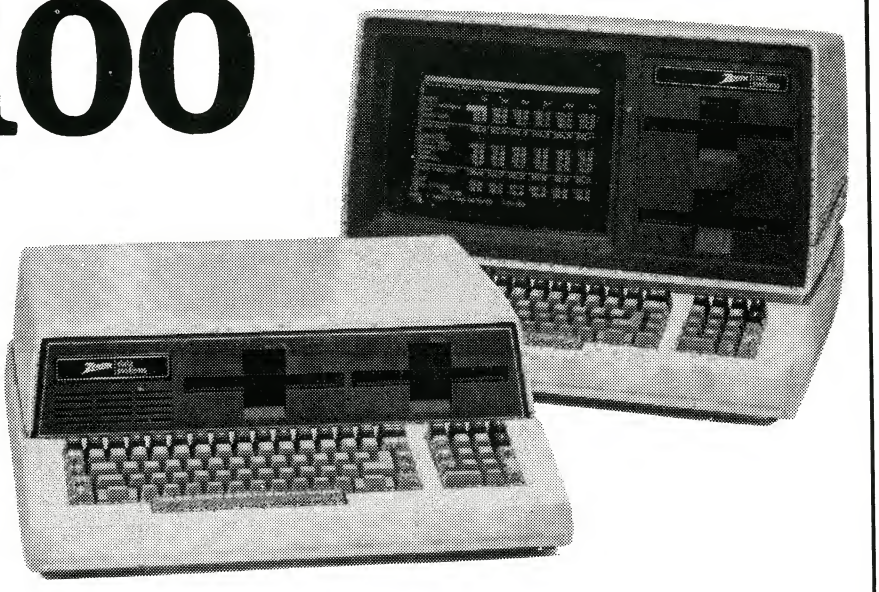
And, as a special extra benefit, the Faire closes at a reasonable hour (6 p.m. Friday and Saturday, 5 p.m. on Sunday). So you should have ample time for touristing. Which is not to be forgotten, because outside the Faire, it is, as always, San Francisco. Probably reason enough for the trip on its own, San Francisco is still "everybody's favorite city." (We have that on no less an authority than the San Francisco Convention and Visitors Bureau.)

There will be the usual fog, hills, Golden Gate Bridge, and assorted et cetera. I should warn inveterate touristers, though, that one San Francisco institution will be in mothballs for this Faire: they're refurbishing the cable cars, although I think there'll be some sort of motor-driven substitute running along the cable car route.

Gonna be there?

So, whether your strong suit is Heath/Zenith, or computers in general, or just playing tourist, the West Coast Computer Faire would seem to be something to put on your calendar. If you can't make it, though, watch for the Summer 1983 issue of *Sextant* for our report. We'll be there at the Faire, issues for sale, recording and photographic gear in hand, trying to make sure that the Faire and the world hears all about us, you, Heath/Zenith, the independents, and the entire Heath/Zenith computer community.

IF: Z100

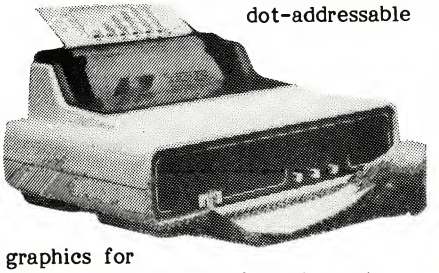


Zenith has created a new generation of desk-top computers and we can offer them to you at a great price. Both 16 and 8 bit microprocessors running at 5MHz provide high resolution color graphic capability with up to 768K of expandable memory! Send for our free catalog describing these units in greater detail and request a color brouchure. Or call us for prices and information on the Z100 series.

IF: Z100... THEN: Keyboard Studio!

MPI

This high quality American made dot-matrix printer features serial and parallel interfaces, 9-wire print-head for true descenders, dot-addressable



graphics for plotting and custom character sets. 80, 96 and 132 column printing and expanded print modes. High quality correspondence printouts using an 11 x 9 matrix is software selectable. Bi-directional and 100 cps printing with tractor and friction feed standard! User defineable type fonts and Z89 graphics in positive and reverse form using the Style Writer CP/M software. (Shown with optional QT sound cover and single sheet feeder.)

ADVENTURE MAKER

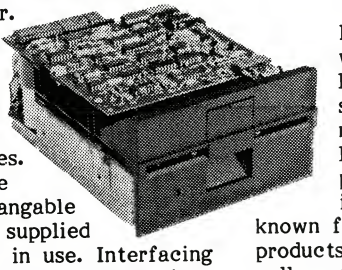
Create your own Adventure type games! It even has provisions for voice output when used with text-to-speech synthesizers! THE ADVENTURE MAKER allows you to design short or long games, with varying levels of difficulty and almost unlimited possibilities. Several pre-made Adventure games are included. Typical Adventure type commands are recognized such as 'pick up bottle', 'use gun', 'drop torch' as well as direction commands. Comes with adventure maps and complete documentation. Requires HDOS 2.0, 64K, MBASIC, Z89 or Z19. $21.

TERMINAL

A menu-driven, screen-oriented modem package for HDOS. A 2K buffer supports CTRL-S/CTRL-Q protocall. Performs large file transfers with only one drive. Has special Smartmodem features and printer output. Programmable AUTOLOG function allows 16 log-on sequences for remote systems. HDOS commands can be executed from TERMINAL. CP/M version coming soon. Comes with a 50 page manual. $25

TANDON

The finest in disk drives, TM-100-4 units are 96 tpi and double-sided. Each drive yields a total capacity of 400K bytes with the standard hard-sector controller and 640K bytes using the Zenith Z89-37 double-density controler.



We also stock the TM-100-1 (48 tpi) and TM-100-2 (48 tpi double-sided) disk drives. The Tandons are directly interchangable with the Heath supplied drives currently in use. Interfacing documentation and manual are included. THINLINE 8" drives (TM-848-2) are also stocked and make an excellent addition to the Z100 computers.

TM-100-4 $359
TM-100-2 $295
TM-100-1 $225
TM-848-2 $510

ETC...

As Zenith dealers, we stock many of the original hardware and software products offered by Heath & Zenith, all at great prices. Other products that we carry include:

Z89 & Z90 Computers	$CALL
NEC RGB monitors	$799
Spellbinder	$289
The Word	$69
Smartmodem 300	$229
Smartmodem 1200/300	$CALL
Rotron Quiet Fans	$22
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5"/8" Drive Enclosures	$Call
Hayes Chronograph	$199
Intex Talker w/music	$275
Votrax synthesizer	$325

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In order to serve you better, we've moved to a new larger location. We now have a showroom to demo equipment and software for our local customers. Also, another phone line has been added for inquiries and orders. We're known for fast service and great products at super prices. Give us a call or use the reader service card to get our new winter catalog.

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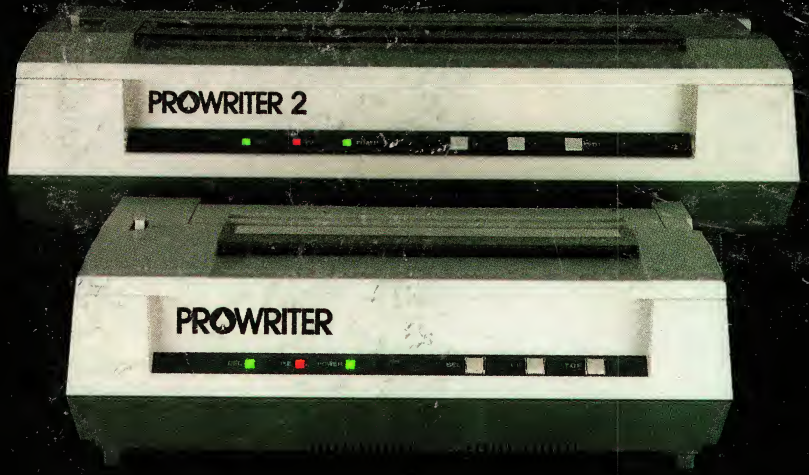
THE PRO'S.

The Prowriters: business printers—and more. The "more" is a dot-matrix process with more dots. It gives you denser, correspondence quality copy (as opposed to business quality copy, which looks like a bad job of spray-painting).
Prowriter: 120 cps. 80 columns dot matrix compressable to 136. 10" carriage. Parallel or serial interface.
Prowriter 2: Same as Prowriter, except 15" carriage allows full 136 columns in normal print mode. Parallel or serial interface.

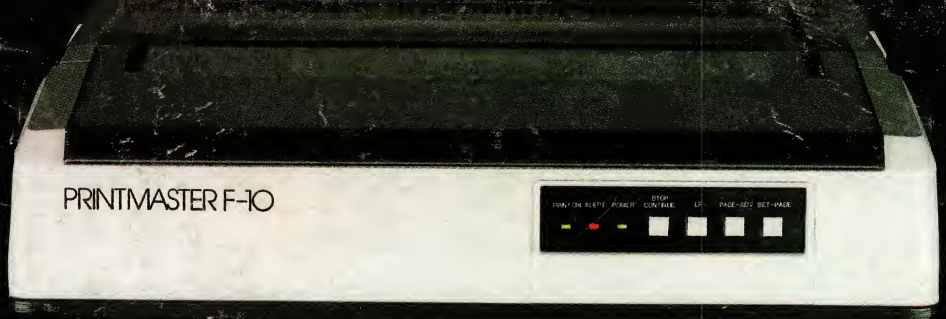


THE STAR.

The Starwriter F-10. In short (or more precisely, in a sleek 6" high, 30-pound unit), it gives you more of just about everything—except bulk and noise—than any other printer in its price range. It's a 40 cps letter-quality daisy-wheel with a bunch of built-in functions to simplify and speed up word processing. It plugs into almost any micro on the market, serial or parallel.

THE MASTER.

The Printmaster F-10. Does all the same good stuff as the Starwriter except, at 55 cps, the Master does it faster.



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